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INDUSTRIAL DEVELOPMENT STRATEGIES FOR FISHERY SYSTEMS IN DEVELOPING COUNTRIES

Volume 1

Sectoral Studies Series
No.32

SECTORAL STUDIES BRANCH
STUDIES AND RESEARCH DIVISION

Main results of the study work on industrial sectors are presented in the Sectoral Studies Series. In addition a series of Sectoral Working Papers is issued.

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Preface

The present UNIDO study, prepared in close co-operation with FAO, provides an assessment of and strategy design for the development of the industrial system related to the fisheries sector of 64 developing countries. This study will serve as a starting point for UNIDO's programme and project development work and as a background to other UNIDO activities related to the fisheries sector. The study will also practically serve government planners, international technical assistance and aid-giving organizations as well as industry and banking in the private sector of the developing countries themselves.

The main results of the study have been summarized in "Industrial development strategies for fishery systems in developing countries: presentation of the main results", PPD.28. A special study entitled "Environmental assessment and management of the fish processing industry", PPD.15, has also been issued and another volume "The integration of women in fisheries: a human resource perspective" is being prepared. The methods used will be documented in volume 2 of this study. Furthermore, it is the intention to issue the main country case studies described in this volume as well as the comprehensive data base that has been compiled and which is the basis for the present work.

This study has been carried out by the Sectoral Studies Branch under the supervision and general guidance of Ms. Teresa Salazar de Buckle. Mr. Clifford Zinnes has provided the statistical and economic framework for the analysis. The following consultants provided assistance in the preparation of the study: Mr. David Thomson, main author of chapter 2 and a contributor to chapters 4 and 7. Messrs. Terence M. Burley and Michael Gregory, Agro-economic Services Ltd., collaborated on the selection and collection of data. The summary case studies of chapter 5 were based on country case studies prepared by Messrs. Benito Rossi (Peru), Alfonso Cebreros Murillo (Mexico), Reuben Charles (Guyana), Hugo Montecinos Castillo (Venezuela), Bernard Dioh (Senegal), Eduardo Ortun (Angola), Alister Goodlad (Somalia), David Thomson (Cuba, Indonesia, Philippines, Zambia). The following consultants also contributed on an honorary basis in the synthesis and revision of the research used for chapters 5 and 7: Ms. Pavla Jezkova, Messrs. Guillermo Castella, Felipe Menjivar.

Contents

	Page
Executive Summary	x
1. INTRODUCTION	1
1.1 Background and overview	1
1.2 Structure of the report	3
2. FISHERIES OVERVIEW	5
2.1 Production, potential and management	5
2.1.1 Aquaculture	13
2.1.2 Management	14
2.2 Structure of fishing operations	17
2.3 Disposition of world catch	20
2.4 World fish trade	23
2.4.1 Tuna	24
2.4.2 Shrimp	26
2.4.3 Fish meal	30
2.4.4 Cured fish	32
2.5 Consumption	35
3. DEFINING FISHERIES INDUSTRIAL SYSTEMS	40
3.1 Lack of focus in development programmes and projects	40
3.2 The Fisheries Industrial System (FIS)	41
3.3 Description of the FIS	42
3.4 The nine FIS components	42
3.5 The variables	44
3.5.1 The FIS basic characteristic variables	44
3.5.2 The FIS constraint variables	48
3.5.3 The FIS enhancement variables	51
3.6 Country selection for the analysis	52
4. IDENTIFYING PATTERNS OF DEVELOPMENT	55
4.1 Background and objectives	55
4.2 Resulting development patterns	56
4.3 Characteristics of the development patterns	56

Page

5. THE COUNTRY CASE STUDIES 70

  5.1 Zambia 74

  5.2 Angola 76

  5.3 Mexico 78

  5.4 Venezuela 81

  5.5 Indonesia 83

  5.6 Guyana 86

  5.7 Peru 89

  5.8 Philippines 91

  5.9 Somalia 94

  5.10 Senegal 96

  5.11 Cuba 98

6. CHARACTERIZING FISHERIES SYSTEMS 101

  6.1 Characterizing the FIS components 101

  6.2 Characterizing the FIS attributes 106

    6.2.1 Frequency analysis by continent 106
    6.2.2 The relationship among FIS attributes 109

7. FIS STRATEGIES AND SUGGESTED DEVELOPMENT ACTIONS 117

  7.1 General comments 117

  7.2 Group-specific development strategies and actions 118

  7.3 A resumé of development actions 140

    7.3.1 Summarizing development actions by component 142

  7.4 Opportunities for co-operation among country groups 146

  7.5 Summary of required technical assistance activitie and investment 147

Tables

Page

2.1 World fish production, 1975 and 1985 6
2.2 Fish production of leading 55 countries or areas, 1975-1985 7
2.3 World fish production: major groups of species, 1972-1984 9
2.4 World fishery resources 12
2.5 Estimated aquaculture production 1985 14
2.6 Comparison of artisanal and industrial sectors 19
2.7 Fish production and food supply, average 1980-1982 21
2.8 World tuna production by species, 1980-1984 25
2.9 World tuna production by major tuna-fishing nations, 1980-1984 26
2.10 Shrimp imports (all types) into the 15 major markets, 1977-1983 28
2.11 International trade in fishery commodities by principal importers and exporters, 1982-1985 33
2.12 Fish consumption programmmes in South America 37
2.13 Fish supplies and consumption, 1980-1982 38
3.1 The FIS characteristic variables 45
3.2 Aggregated quantitative measures of each component describing the present status of FIS 48
3.3 A description of the 27 constraints by FIS component 49
3.4 A description of the 15 enhancements by FIS component 51
3.5 The 64 selected developing countries 53
4.1 Summary of development patterns identified 58
Appendix 1
  Table 1. Probabilities of FIS constraints to occur in the various country groupings 68
  Table 2. Probabilities of FIS enhancements to occur in the various country groupings 69
5.1 General fisheries data for the country case studies 71
6.1 Country rankings according to each FIS component 102
6.2 Distribution of countries by components 104
6.3 The relationship between FIS components as described by their pairwise correlations 105
6.4 Most commonly observed FIS constraints by continent 107
6.5 Most commonly observed enhancements to FIS development by continent 109
7.1 Group 1: The least favoured countries 121
7.2 Group 2: Largely state controlled fisheries 123
7.3 Group 3: Low priority fisheries 125
7.4 Group 4: Labour-intensive fisheries 128
7.5 Group 5: Small states with growth potential 130
7.6 Group 6: Large but fluctuating resources and limited local demand for fish 132
7.7 Group 7: Laissez-faire fisheries 135
7.8 Group 8: Lack of industrialization 137
7.9 Group 9: Likely exporters 139
7.10 Group 10: Long distance, state controlled 141
7.11 Group-specific actions 143
7.12 Technology expertise available in developing countries applicable to south-south co-operation 148
7.13 Technical assistance activities and investment requirements 149

Figures

Page

2.1 World fish catch, 1979-1985 6
2.2 Total and unexploited fishery potentials 11
2.3 World fishery exports and imports, 1979-1985 24
2.4 World tuna production by species, selected years 25
2.5 Major shrimp producers, 1981 27
2.6 World production of shrimp, 1972-1984 28
2.7 Total expected imports of shrimp of 15 major countries in 1990 29
2.8 Total imports of shrimp of 15 major importing countries, 1977-1983 29
2.9 World production of fish meal, 1960-1984 30
2.10 World production of fish body oil, 1960-1984 30
2.11 Prices of fish oil and soyabean oil, 1960-1984 31
2.12 Prices of fish meal (65%) and soyabean meal (44%), 1960-1984 31
3.1 Base diagram for a FIS indicating the nine components and their linkages with the rest of the economy 43
3.2 Map indicating location of countries according to country number 54
4.1 Patterns of development of groups across FIS components 57
5.1 Base diagram FIS Zambia 1983 75
5.2 Base diagram FIS Angola 1985 77
5.3 Base diagram FIS Mexico 1984 79
5.4 Base diagram FIS Venezuela 1984 82
5.5 Base diagram FIS Indonesia 1984 84
5.6 Base diagram FIS Guyana 1985 87
5.7 Base diagram FIS Peru 1984 90
5.8 Base diagram FIS Philippines 1984 92
5.9 Base diagram FIS Somalia 1984 95
5.10 Base diagram FIS Senegal 1983 97
5.11 Base diagram FIS Cuba 1984 99

Glossary

Aquaculture:	Activity which is performed in brackish coastal areas, irrigation reservoirs, canals, natural and man-made ponds, tanks, cages, pens and lagoons. It involves propagating and raising aquatic organisms under human control and manipulating at least one stage in their life cycle before harvesting.
Arthropods:	Animals having an external skeleton segmented to allow for movement (crustaceans).
Artisanal sector:	This consists of those activities typified by a low level of capital investment and which have developed from local fishing traditions which have been passed on through the family. These activities are generally small-scale, undertaken by the fisherfolk themselves in a self-employed, family, or village co-operative organization. These fisherfolk are artisans and are not employed in any incorporated business. Traditionally, this sector has had a marked reliance on natural, i.e., unprocessed, energy sources, such as wind, sun, manpower and wood fuel. Artisanal fisheries are linked to the national economy, upstream with boats, equipment and net manufacture and downstream with the artisanal processing and with the commercial processing sector, through the provision of raw materials.
ASEAN:	Association of South East Asian Nations.
Attribute:	Refers to the group of FIS variables which indicates the presence or absence of FIS constraints and enhancements to development.
By-catch:	The other fish caught in the nets used to harvest a given species and which are subsequently thrown back into the sea, either damaged or dead.
Canned fishery products:	Fish, shellfish, or other aquatic animals packed in cans, jars, or other containers.
Capture fisheries:	Fisheries activities which are by far the most important and which refer to the harvesting of natural fish stocks found in oceans, freshwater lakes and rivers, along with the handling, marketing, processing and distribution of fish and fish products.
Cephalopod:	Any of a class of molluscs including squid, cuttlefish and octopus.

Coastal zone:	Strip of land of variable width along the shoreline under the direct environmental and economic influences of the adjoining body of water.
Commercial sector:	This refers to that part of the extraction and processing industries owned and run as incorporated business. These activities generally involve considerable investment in plant and equipment or vessels. It is this part of the FIS which mostly supplies the export markets or the local markets for higher value processed fish. Note that in this study, the commercial sector is meant to include all industrial fish processing (excluding that carried out by artisanal methods) and not just reduction to fish meal and fish oil as is sometimes the case in other studies.
Cured fishery products:	Products preserved by drying, pickling, salting and smoking.
Demersal:	Refers to fish that live on, or adjacent to, the sea bottom.
Development pattern:	See "Group".
EEZs:	Extended Economic Zones. The jurisdiction of waters up to 200 miles from shore placed in the hands of individual coastal nations
Fish:	Includes finfish, molluscs, crustaceans and all other forms of marine animal and plant life other than marine mammals, birds and highly migratory species.
Fish meal:	A high-protein, animal-feed supplement made by cooking, pressing, drying and grinding fish or shellfish.
Fish oil:	An oil extracted from body (body oil) or liver (liver oil) of fish and marine mammals; mostly a by-product of fish meal production.
Fishery resource:	Any fishery, any stock of fish, any species of fish and any habitat of fish.
Group:	A sub-group of objects (in this case countries) from a sample which, based on a pre-defined set of characteristics (in this case FIS components), are more similar than the other objects in the sample. A group is one of (usually) many which together comprise a classification or clustering and result from carrying out a cluster analysis. This analysis provides a handy way to aggregate multiple characteristics. In the present case, each cluster represents one FIS development pattern.

Industrial fishery products:	Items processed from fish, shellfish, or other aquatic plants and animals that are not consumed directly by humans.
JUNAC:	Junta del Acuerdo de Cartagena.
Klondyker:	It is a vessel which loads and processes herring or mackerel in another state and transports them home quickly for reprocessing and marketing. The initial processing on board involved icing and salting only on the original klondykers. Modern ones may freeze the fish.
Maximum sustainable yield (MSY) and Optimum sustainable yield (OSY):	The MSY is the largest animal catch or yield in terms of weight of fish caught per year that can be taken from a stock under existing environmental conditions and maintain it at current biomass levels year after year. The OSY is similar to the MSY but takes into account the possibility that current biomass levels may not be at their potential level attainable and that the government may wish to raise them over time.
MEPS:	The UNIDO-JUNAC computerized methodology for the assessment and programming of production/consumption systems.
Pelagic:	Relating to communities of marine organisms that belong to the open sea, living free from direct dependence on bottom or shore.
Stock of fish:	Species, subspecies, geographical groupings, or other category of fish that can be managed as a unit.
TCDC:	Technical Co-operation among Developing Countries.

EXECUTIVE SUMMARY

The present UNIDO study, prepared in close co-operation with FAO, provides an assessment of and strategy design for the development of the industrial system related to the fisheries sector of 64 developing countries. The study is based on a rigorous and consistent framework whereby the fisheries sector is analyzed as a system of integrated components. In doing so, it recognizes the fisheries sector's important contribution to national, economic, social and institutional goals as well as the potential conflicts in meeting such multiple objectives.

Starting from the basic concept of a fisheries sector as an integrated system and the definition of a fisheries industrial system (FIS) countries are characterized, specific development patterns are identified, strategies and their consequent actions determined, and investment opportunities and technical assistance options revealed. In the process, a host of propositions are presented for discussion about the various economic, technical, and political components of a fisheries industrial system.

This study will serve as a starting point for UNIDO's programme and project development work and as a background to all other UNIDO activities related to the fisheries sector. Together with the methodology itself (fully described elsewhere[a]) this study will also practically serve government planners, international technical assistance and aid-giving organizations as well as industry and banking in the private sector of the developing countries, themselves.

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a/ "Patterns of Sectoral Industrial Systems: Methodology for their Analysis, Monitoring and Strategy Design", forthcoming.

1. INTRODUCTION

1.1 Background and overview

The importance of the fisheries sector's contribution to national economic, social and nutritional goals is now widely recognized and principles for a strategy and plan of action for fisheries management and development have been laid down. Objectives should be based on an assessment of the fishery resources available, and on markets to be served, but also other factors, including foreign operations, must be considered. Most important, the fisheries sector should be viewed as a system in which different industrial, production, consumption and policy components interact. Correspondingly, development strategies should be comprehensive in nature and should address multiple objectives.

These principles were recognized at the FAO World Conference on Fisheries Management and Development, held in Rome, July 1984. The present study prepared by UNIDO in close co-operation with FAO provides an assessment according to the above principles for 64 developing countries. As such, this effort provides a good example of a UNIDO-FAO co-operation: FAO identifies the overall fisheries sector's needs and UNIDO determines the investment and technical assistance requirements for the sector's industrial components.

The findings in the present study are achieved in three steps. First, the fisheries sector of each country is described in terms of a fisheries industrial system (FIS). This permits the disaggregation of the sector into its component subsystems and linkages to the rest of the economy taking into consideration economic, technological, sociological and policy factors affecting fisheries production and consumption. Next, based on the first step, countries are grouped according to similarities of their fisheries sector development. Accordingly, each country group can be considered as a pattern of development. Finally, comprehensive pattern-specific development strategies covering the areas of investment, technical assistance and regional and international co-operation are proposed together with corresponding suggestions for action.

For each identified development pattern a country case study has been undertaken. These studies provide in-depth and country-specific details, illustrate more closely the development patterns and contribute to the assessment of constraints and factors of enhancements for each group. Pattern-specific strategies and actions necessary to eliminate problems that hinder their successful application were also analyzed in light of the experiences found through the country case studies.

The methodological approach developed and used for the study is fully described in a second volume entitled "Patterns of Sectoral Industrial Systems: Methodology for their Analysis, Monitoring and Strategy Design". The potential of applying this approach to the analysis and follow-up of other industrial sectors in a global context is excellent and is one of the reasons for describing it in detail in a separate volume.

Major outputs of the study are:

- An assessment of the fisheries systems of 64 developing countries within a comprehensive development planning approach (as suggested by the FAO Fisheries Conference) and the identification of 10 patterns of development prevailing in the fisheries systems of the 64 developing countries. These country groupings are not the result of political, geographic or other non-fishery specific industrial classifications. They depend solely on those considerations be they economic or otherwise which specifically relate to the development of the fisheries sector.

- Comprehensive development strategies for the 10 identified fisheries patterns of development.

- Pattern-specific actions to be promoted in order to implement the strategies and eliminate major problems hindering their successful application.

- A description of the actions in terms of concrete investments, technical assistance, policies, support actions and mechanisms to be applied to the different components of the FIS of the 10 groups of countries as well as options for co-operation between the countries in this regard.

- A set of issues and structural relationships are presented to stimulate discussion covering a broad range of topics concerning fisheries as an industrial sector.

- A cross-country methodology for consistenly evaluating sectoral patterns and providing a frame of reference for designing development strategies (Volume 2).

Due to the methodology employed in this study, a number of benefits emerge that would have been unattainable otherwise using the more conventional study approaches. First and foremost are the creation and presentation of development strategies which are not just internally consistent but also are tailor-made to each of the current types of development patterns observed today. A second fundamental benefit is that by analyzing a country's FIS as an integrated system, there is a greater likelihood that the resulting programmes and projects will be better suited to the targetted countries, hence more likely to meet with long term success.

Finally, by synthesizing expert opinion, statistical technologies and broadly-based data collection all for 64 countries the approach used in this study provides two further advantages. First, each relationship identified represents a specific underlying tendency across existing FISs and therefore should not be overlooked in policy design. Second, this study provides a rare opportunity to go beyond the detailed but country-specific and therefore limited knowledge and experience of individual FIS experts.

In addition to the above the results of this study are intended to benefit several users. First, government fisheries planning offices and ministeries of fisheries of the 64 countries can directly use the outputs of the study for programming the sector and setting priorities for actions in an integrated manner. Second, for developing countries the study provides the possibility of sharing and benefitting from other countries' development experiences, one of the most interesting means of self-help among developing countries. Third, this work will also be of use to international technical assistance and for aid-giving financial organizations promoting the development of the fisheries sector, in designing programmes for country groups rather than for individual countries. Finally, the methodology and analyses which underpins the results presented herein should itself be of practical use to business and government alike. In addition to the present volume, other concrete examples of its application are found in Volume II.

1.2 Structure of the report

This introductory chapter is followed by a chapter which provides the background for the main body of the study by positioning developing countries within the context of world fisheries activities by giving a concise overview of the present situation and trends of the fisheries activities with regard to production, potential catch, major species, processing, the structure of fishing operations, fish utilization, international trade and consumption. Chapter 3 describes the methodological approach used for evaluating country-specific fisheries systems.1/

The concept of development patterns is introduced in chapter 4 and the patterns among the 64 countries are identified and characterized in terms of the framework outlined in chapter 3. (A graphic representation of the patterns is given in figure 4.1.).

The process used for the selection of representative countries from the 10 patterns to be subject of further study (country case studies) is illustrated in chapter 5 followed by brief descriptions of the 10 fisheries industrial systems representing the patterns.2/ The structure of the FIS for each case is represented through a base diagram where the components interacting in the system and their linkages are shown. The base diagram also contains economic and physical flows and data on installed capacity and capacity utilization, providing a quick view of the system characteristics and orientation. The full versions of these case studies are available in their original languages upon request.

Chapter 6 analyzes the frequency of occurrence and the causes and effects of the constraints and enchancements affecting the FIS of the 64 countries thus contributing to the understanding of linkages between the FIS components and to the appropriate formulation of development strategies.

Chapter 7, based on the major findings resulting from an analysis of the fisheries sector characteristics and the country case studies, discusses development objectives and suggests development strategies specific to each one of the 10 identified patterns of development. This chapter also suggests pattern-specific development actions, derived on the basis of the pattern characteristics and potential (tables 7.1. to 7.10.). Examples of appropriate actions taken by specific states within each pattern are also given. These examples should be useful to countries in the pattern and to other countries with similar problems and constraints.

1/ For an extended description of the methods, the reader should consult Volume 2.

2/ Angola, Cuba, Guyana, Indonesia, Mexico, Peru, the Philippines, Senegal, Somalia, Venezuela and Zambia.

A résumé of the pattern-specific priority actions suggested as a result of the present study is given in tables 7.11. and 7.12. These tables show the multiple actions that have to be taken within the concept of integrated FIS development by the governments and the private sector, promoted by international and bilateral agencies and aid groups and supported by international banks and other agencies. Thus, starting from the basic concept of a fisheries sector as an integrated system, countries are characterized, development patterns are identified, strategies and their consequent action determined and investment opportunities and technical assistance options revealed.

The development and execution of technical assistance and investment programmes to the integrated development of the FIS should be facilitated by the use of appropriate strategies and actions elaborated on the basis of this analysis. At the same time investment and technical assistance actions common to several patterns, as identified in the present study, will provide the basis for structuring specific training and research and development programmes for groups of patterns as well as promoting south-south international co-operation. The latter possibility is illustrated in table 7.13.

The quantification of these actions should come after the full application of system-oriented analytical tools such as MEPS (methodology for assessing, programming and management of production/consumption systems) at the individual country level.3/

3/ See document UNIDO/IS.643, Sectoral Studies Series No.27, 1986, "Methodology for the Assessment, Programming and Management of Production and Consumption Systems".

2. FISHERIES OVERVIEW[4]

2.1 Production, potential and management

World fish production reached a record total of 84.9 million metric tons in 1985. The increase of 7.7 per cent registered between 1983 and 1984 was the largest annual increase for over 16 years. During the 1950s and 1960s, the world catch was growing at an average rate of 7 per cent, but this slowed down to about 2 per cent in the 1970s.

Some 10 per cent of the physical production comes from inland lakes and rivers, the remaining 90 per cent from the seas and oceans. The largest and most important single group of marine species is the small pelagics which include herrings, pilchards, sardines and anchovies. These comprise over 23 per cent of the world catch. The demersal species, cods, redfish and flounders make up 22 per cent while mackerels, tunas, jacks and souries form 19 per cent of the total. Their relative proportions have remained fairly constant over recent years despite fluctuations in anchovy, pilchard and herring stocks.

Fish resources and catches are not evenly distributed. More than three quarters of the world catch is taken by the 18 leading fishing nations. Two countries, Japan and the USSR, together account for over 25 per cent of all fish production. Geographically, the most productive marine areas are the Pacific North West, the Atlantic North East and the Pacific South East. Catches by continental regions are indicated in table 2.1.

As far as developing countries are concerned, the most flourishing and the most promising fisheries are located in Asia and the Far East. Latin America is still recovering from the drastic effects of the collapse of the anchovy fishery. It also has a relatively smaller domestic market to supply.

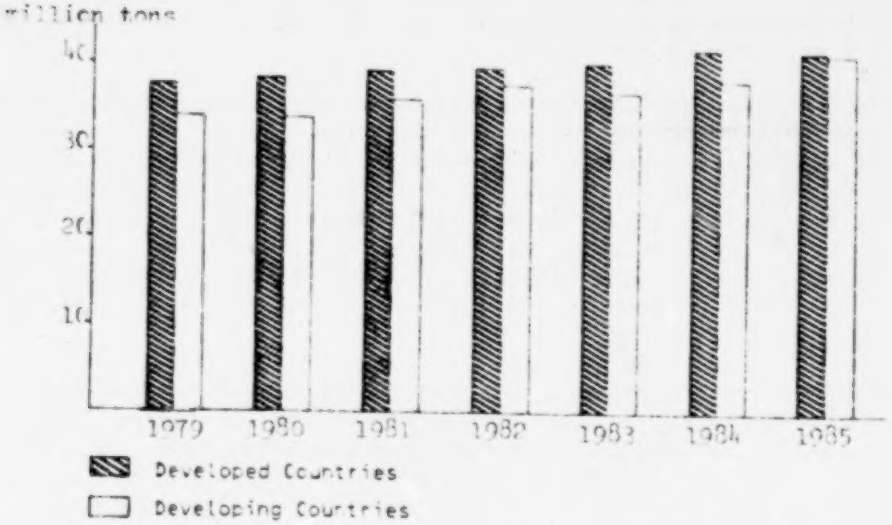
In Africa many fisheries have actually declined in the past 10 to 15 years. Overall fish production in Africa is static at near 1975 levels. Two major causes of the poor production are the drought in the Sahel and the instability brought about by wars or insurrection. Africa's potential remains high nevertheless, both in marine and freshwater fisheries.

The extension of fishery zones to 200 miles has created opportunities for some maritime countries and brought problems to others engaged in distant water fishing. Few countries which have acquired large Extended Economic Zones (EEZs) have benefitted immediately. This is for a number of reasons, but chiefly because of the difficulty of policing such a large area and because fish stocks are less abundant and more migratory in the deep oceans. Most fishing activity is concentrated on the continental shelf from the shore line out as far as the 200 fathom depth contour, and there is much less activity over the deep ocean.

Many development projects as well as uncontrolled fishing effort increases have led to overfishing and the concept of fisheries rehabilitation (as in reforestation) needs to be introduced. This means investing in enhancement of production, but not in additional gear. This is easier to accomplish in freshwater or inland fisheries but has been successfully applied in coastal fisheries (in Japan) and in certain high seas fisheries such as that for salmon.

4/ This chapter has benefitted from a substantial contribution from FAO.

Figure 2.1. World fish catch, 1979-1985



Source: FAO Fisheries Circular 801, F11/C801.

Table 2.1. World fish production, 1975 and 1985
(thousand metric tons)

Region	1975	1985
Far East[a]	17,100	22,500
Asia & Southeast Asia	8,100	11,000
Europe	12,000	12,000
USSR	9,900	10,500
South America	5,900	11,700
North America[b]	4,500	7,900
Africa	3,700	4,400
Oceania	100	500
Others[c]	4,300	4,400
Total	65,600	84,900

a/ Japan, China, Democratic People's Republic of Korea and Republic of Korea.

b/ Including Central America.

c/ Countries with catches under 150,000 metric tons/year in 1985.

Table 2.2. Fish production of leading 55 countries or areas, 1975-1985 (thousand metric tons)

Country or area	1975	1978	1981	1985
Japan	9,896	10,186	10,741	11,444
USSR	9,964	9,000	9,546	10,523
China	4,247	4,394	4,377	6,779
Chile	2,842	3,418	3,767	4,804
United States	899	1,929	3,385	4,767
Peru	3,446	3,473	2,741	4,168
India	2,266	2,306	2,444	2,810
Republic of Korea	1,887	2,092	2,366	2,650
Thailand	1,553	2,098	1,989	2,124
Norway	2,484	2,593	2,552	2,107
Indonesia	1,382	1,642	1,907	2,067
Philippines	1,443	1,495	1,687	1,868
Dem.P.Rep. Korea	1,050	1,260	1,500	1,700
Denmark	1,767	1,740	1,852	1,696
Iceland	995	1,567	1,441	1,680
Canada	993	1,368	1,417	1,426
Spain	1,512	1,373	1,257	1,338
Mexico	468	782	1,536	1,226
Brazil	753	803	829	959
Ecuador	224	616	731	901
France	784	769	778	845
Viet Nam	546	583	622	800
Bangladesh	640	645	687	764
Poland	801	571	630	683
South Africa	600	605	607	650
Burma	485	540	595	644
UK - Scotland	442	456	499	639
Malaysia	474	685	804	632
Turkey	122	244	470	576
Italy	406	399	450	504
Netherlands	351	324	434	504
Morocco	225	293	391	473
Argentina	214	519	362	411
Pakistan	195	293	318	408
Faeroe Islands	286	318	242	362

Table 2.2. Fish production of leading 55 countries or areas, 1975-1985 (continued)

Country or area	1975	1978	1981	1985
Portugal	378	253	260	299
Venezuela	153	175	192	283
New Zealand	63	93	108	283
Panama	117	139	149	282
Tanzania	212	211	231	271
Ghana	255	260	230	254
Sweden	215	193	265	248
Senegal	240	279	207	244
Nigeria	466	519	496	242
Romania	137	138	192	238
Germany Federal Rep.	442	412	331	225
Cuba	143	213	165	220
Uganda	188	224	167	212
Ireland	88	104	191	206
German Democratic Rep.	376	198	245	198
Area of Hong Kong	151	162	182	198
Sri Lanka	125	157	207	175
UK - England/Wales	497	549	350	170
Finland	110	139	133	161
Australia	109	123	146	160
55 countries or areas	61,356	65,926	70,395	80,500
Other countries or areas	4,244	4,074	4,205	4,400
World total	65,600	70,000	74,600	84,900

These 55 countries or areas are those with catches of 150,000 metric tons or more in 1985.

Source: FAO, Yearbook of fishery statistics.

Table 2.3. World fish production: major groups of species, 1972-1984 (thousand metric tons)

	1972	1978	1984
Marine fish			
Herring, sardine, anchovy	13,300	13,300	19,200
Cod, hake, haddock	11,400	10,300	12,200
Jacks, mullets	5,000	8,100	8,600
Redfish, bass, conger	4,300	5,700	5,500
Mackerel, snoek, cutlassfish	3,100	5,300	4,100
Tuna, bonito, billfish	2,000	2,500	3,100
Squid, cuttlefish, octopus	1,200	1,300	1,700
Flounder, sole, halibut	1,300	1,200	1,200
Sharks, skate, ray	500	600	700
Marine shellfish			
Shrimps, prawns	1,100	1,700	1,900
Clams, cockles	700	1,100	1,500
Oysters	800	900	1,000
Crabs	400	800	800
Scallops	200	400	800
Mussels	500	600	700
Lobsters	200	200	200
Krill	-	100	100
Anodromous and diodromous fish			
Salmon, trout, smelt	500	600	900
Shad	800	800	700
Diadromous fish	100	400	500
Freshwater fish			
Misc. freshwater fish	5,000	4,800	6,600
Carps, barbel, catfish	500	600	800
Tilapias, bream	200	300	500

Source: FAO, Yearbook of fishery statistics.

Although statistics show that fish production continues to increase, most of the traditional stocks are being fished at or close to their maximum sustainable yield. Several major species have been over-harvested at times and this has resulted in the collapse of the particular fishery and subsequent introduction of strict management measures. This has happened to the North Atlantic herring, the south-western African pilchard, and the Peruvian anchovy. Many resources also show wide fluctuations in production in response to natural human activities. To predict these changes is extremely difficult, which of course, complicates the question of deciding on an appropriate development and management strategy. Further increases in marine production are possible but they will probably have to come chiefly from the few stocks of less exploited species which of course, present both harvesting and marketing problems, and from a reduction of wastage and improvement in management strategy of coastal states.

Nearly ten million tons of edible fish are lost or wasted each year due to spoilage ashore and dumping of by-catch at sea. If either or both of these losses could be significantly reduced, this would also result in an increase in the amount of food fish reaching the consumers.[5/]

An effective increase in production of six per cent, or 5.0 million metric tons could be obtained if post harvest spoilage could be eliminated. It is estimated that spoilage rates average 10 per cent for fresh water fish and 25 per cent for cured fish. These could be reduced dramatically by the introduction of basic hygiene in fish markets, use of ice, fly screening, and speedier discharge, sale and delivery of fish catches. A further similar saving of over 5.0 million metric tons could be achieved by utilizing the discarded fish or by-catch from trawlers working exclusively for shrimp. There are economic and technical difficulties involved in by-catch utilization but they are not insurmountable as some pilot programmes have demonstrated.

Fishery scientists have concluded that a total annual harvest of around 100 million metric tons may be sustainable, although whether this harvest can be achieved with an economically acceptable rate of return to coastal states, is far less certain in all cases, and would require careful analysis beforehand. To achieve it there would have to be a considerable increase in aquaculture, and the harvesting of Euphausids (krill), Cephalods (squid) and Mesopelagics (small deep water fish) and/or decrease in present losses due to spoilage. There is also some potential for a considerable increase in seaweed harvesting.

World demand for fish and fish products is expected to rise to around 100 million tons by the year 2000.[6/] Thus, given efficient harvesting and marketing, conventional fishery resources could just about keep pace with demand over the next 10 to 15 years.

For most developing countries future production increases will come chiefly from distant or offshore fishery grounds, from better management, by replacement of foreign fleets (if decided), and from culture or farming of fish and shellfish in coastal, estuarine or inland waters. Both options require greater capital and technical inputs to provide the infrastructure, equipment and skills necessary. Marine offshore resources fall into four main categories : tunas, small pelagics, squid and deep water mesopelagics. Krill are found only in Antarctic waters. Each species requires special harvesting gear and techniques and appropriate processing facilities. Apart from the capital investment necessary, there are higher operating costs involved in extraction and preservation. These result mainly from the greater amounts of fuel consumed in distant water fishery and from the sophisticated preservation methods involved.

5/ See on this topic UNIDO document PPD.15, Sectoral Studies Series No. 28, 1986, "Environmental assessment and management of the fish processing industry".

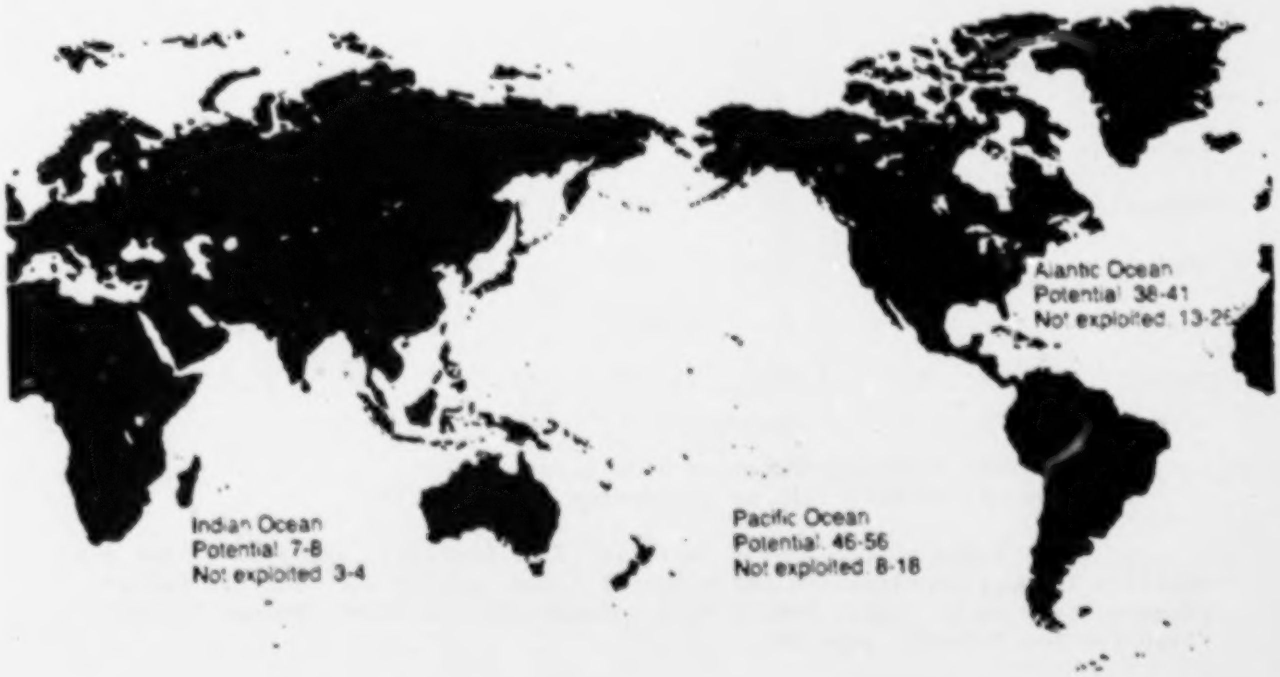
6/ Conference, FAO, Rome, twentieth session; Rome 10-29 November 1979. Agriculture: Toward 2000. Table 6.4, p.119. C 79/24.

Over-capitalization has occurred in the commercial fish capture sector of several countries. The result is too many boats chasing too few fish and few of them reaping an adequate financial return for their efforts. This phenomenon applies to specific fisheries within countries and can be seen in much of Asia and the Far East, and ports of Latin America and the Caribbean. The situation in Africa is difficult to assess because of the amount of fishing by foreign fleets operating under licence or in joint ventures.

Examples can be found in the tuna and shrimp fisheries particularly in places like the Philippines, Malaysia, Mexico and Venezuela, and in some dermersal and shellfish industries. Some artisanal fleets also have an excess number of vessels but they generally use passive gear and are not really capable of harming fish stocks. Also their fishermen are mostly landless peasants with little or no alternative sources of income.

If over-capitalized commercial fishing fleets can be rationalized, reduced to an acceptable number and limited in quantity and size or power by licence, then each unit becomes more profitable. This results in technological investments in the vessels which in turn creates work for support industries ashore. In the classic case of 'limited entry' management in Canada's Pacific herring fishery, the increased investment in vessel technology created more jobs in manufacturing and service industries than were lost from fleet rationalization.

Figure 2.2. Total and unexploited fishery potentials (million tons)



Source: INFOFISH Marketing Digest No. 4/84.

Table 2.4. World fishery resources
(thousand tons)

	Current production				Potential increase		
	Used for human consumption	Lost by spoilage	Industrial use or animal feed	Total production	From by-catch dumped at sea	Short term (15-20 years)	Long term (30-50 years)
Species currently well exploited							
Freshwater fish	8,600	300	-	8,900	-	4,200	10,000 (1)
Demersal fish	13,700	1,800	7,000	22,500	6,000	2,000	2,000
Small pelagics	18,800	3,400	15,400	37,600		6,000	5,000
Other	2,700	200	100	3,000		2,000	2,000
Shellfish	8,600	300	-	8,900		1,000	3,000 (1)
Less exploited species							
Cephalods	1,500	-	100	1,600		3,000	8,000
Mesopelagic	-	-	100	100		2,500	15,000 (2)
Euphasids	-	-	100	100		1,300	10,000 (2)
Seaweeds	1,800	-	1,200	3,000		3,000	5,000 (1)
Total	55,700	6,000	24,000	85,700	6,000	25,000	60,000

(1) Assumes large expansion of aquaculture.
(2) Assumes breakthrough in processing and marketing.

Source: Based on table by K. Whittle (1981 figures), updated to 1984 and modified to more conservative estimates of future potential. Whittle table based on data by D. James, FAO in Food Science and Nutrition, Volume 4, 1983, "Fish for the Future", page 39.

Some states have not yet exploited their coastal or inland waters to the full. This is mostly because of the remoteness of the fishing grounds or villages from the main markets, and the lack of adequate roads, transport, ice or preservation facilities. The small scale fishing fleets which mainly harvest the inshore waters could benefit enormously from investment in proper marketing and distribution infrastructure.

2.1.1 Aquaculture

For the past ten years aquaculture production has been growing at a much faster rate than capture fisheries, up to 30 per cent per annum for fish and shellfish, and over 40 per cent a year including seaweeds. The total yield from the culture industries was 6.5 million tons of fish and shellfish and 2.2 million tons of seaweed in 1981. By 1984, these had risen to 7.6 million tons and 2.4 million tons respectively.

Close on 80 per cent of all fish farming and some 99 per cent of seaweed farming takes place in Asia. Japan, China, Indonesia and the Philippines have large and well developed aquaculture industries. In 1983, nearly 2 million tons of China's fish production came from culture activities. Fish culture in the Orient takes place primarily in fresh water and brackish water, and to a lesser degree in sea water (although marine molluscs and seaweed together form the bulk of production in weight).

A large number of species are farmed, but chiefly carp and tilipia in fresh water and milkfish in brackish water. Because of their high value, penaeus shrimp are now displacing milkfish in brackish water ponds, and farming of freshwater macrobrachium prawns is on the increase. Mussels and oysters are grown in seawater locations and the farming of giant clams is also now beginning. Seaweeds are grown primarily to supply raw material for the food processing and chemical industries.

Despite the enormous potential for aquaculture in Latin America and Africa, these continents have been slow to develop this sector. The production of South America is less than 2.0 per cent of the world total, and of Africa less than 0.1 per cent. Both continents could produce over a million tons from fish farming, either food fish like the tilapia, or export species like prawns.

One of the constraints to aquaculture development in Africa appears to be the inability of poor people to pay for protein foods. Cultured fish cost more than captured fish and thus require a more buoyant market. There are several major efforts to develop tilapia farming which is the pond equivalent of pasture farming of animals, but progress has been slow. As a ready market exists for shrimp and prawns, the production of these species has tended to attract more private capital despite the more advanced technologies required. The feeding of the young prawns requires minute artemia shrimp or rotifer zooplanktons which need to be cultured or imported.

It requires a capital investment of anything from US$ 100 to US$ 2,000 to produce a ton of fish a year from aquaculture, depending on species and locality. FAO estimated in 1977 that developing countries would need to spend US$ 60 million a year on aquaculture projects to meet national needs. In 1985, Africa alone was in receipt of foreign aid of over US$ 78 million for aquaculture. This, together with government contributions and private investments should boost fish culture in Africa by 100,000 tons. However, most projects are failing to realize their potential.

South America has ambitious plans for aquaculture expansion. Chile recently enjoyed good success with a salmon farming project. Shrimp culture is rapidly increasing throughout the region, led by Ecuador which produced over 26,000 tons in 1984. Various marine molluscs are being farmed around the coasts of Peru, Chile, Mexico, Brazil and Venezuela. Brazil plans a major expansion of freshwater fish culture and is setting up seven hatcheries to produce over 20 million fingerlings of carp and tilapia. Mexico has ambitious plans to increase culture production of high value or export species like prawn, oyster and lobster, and of finfish - carp, catfish, tilapia and trout - for domestic consumption.

Table 2.5. Estimated aquaculture production 1985 (thousand metric tons)

	Total	Fin fish	Molluscs	Crustaceans	Seaweed
Asia and Oceania	8,418	2,916	2,977	88	2,435
Europe	1,316	730	585	-	-
North America	241	150	85	6	-
South America	118	29	51	37	-
Africa	7	6	-	-	-
Total	10,100	3,831	3,698	131	2,435

Source: Stirling University, Scotland.

2.1.2 Management

As a result of extended national jurisdiction over marine resources in adjacent seas and oceans as embodied in the United Nations Convention on the Law of the Sea, 1982, many states have received the impetus needed to reassess and improve the management of their fisheries. To assist them in this exercise, FAO in 1984 convened a World Conference on Fisheries Management and Development which identified problems and suggested strategies and plans of action.

In several regions of the developing world, coastal states are already collaborating on management measures concerning stocks which occur in the Extended Economic Zones of two or more countries, or which migrate from one zone to another. In some cases, joint ventures have been set up with foreign partners to help harvest, process and market an offshore resource which the host country was unable to exploit because of the lack of suitable vessels, plants or expertise.

Management has also become critical in resolving and reducing conflicts between small scale or artisanal fishing fleets and those of commercial companies operating in the same areas. This is a serious social problem owing to the size of the artisanal population and the numbers dependent on it directly or indirectly for food and income.

In focusing attention on management objectives and strategies, fishing countries have become more aware of alternative approaches to development and to optimum utilization of the resource. By judicious investment and use of intermediate or appropriate technologies, it has been demonstrated that in many cases, production targets can be reached with more modest investments of capital, and yet with greater national benefits in terms of employment and stimulation of local industry.

The possibility of rehabilitation and enhancement of fisheries should also be investigated. This is a complex matter involving conservation, management, protection of fishing grounds and stimulation of stock growth. Japan has led the way in this field and other fishing nations are following. There are imaginative plans for artificial reefs, mangrove plantations, fish sanctuaries and marine farms in some countries in South East Asia and Central America.

Under the terms of the United Nations Convention referred to, coastal states have the right within the new regime of the sea to establish laws and regulations for the control of all fishing within their EEZs. These laws may relate to licensing, payment of fees, limiting species or sizes to be caught, or times or areas where fishing may take place or the kind of gear to be used. The coastal states may specify the information required from foreign fishing vessels, on their catches and movements, and may place observers or trainees aboard these ships. The states may insist on the landing of all or part of the catch in its ports as in the Seychelles and Mauritania and may sample the catch of any vessel to verify the ship reports. The coastal states are authorized to determine the terms and conditions of joint fishery ventures or other co-operative arrangements.

Joint venture enterprises or licensed fishing arrangements have not always been satisfactory either for the foreign or the local partner. Some governments have found the cost of policing, monitoring or administering the scheme to be as much or more than the revenues received. Local fisheries bussinessmen are sometimes prohibited from expanding into areas where foreign companies are operating. Coastal or artisanal fishermen complain of competition on their own grounds from the foreign fleets. The foreign partners often complain of recurring difficulties with local government officials at every level in the bureaucracy. There needs to be very careful assessment of the costs and benefits, obligations and disadvantages of such ventures before they are embarked upon.

Nevertheless, some good examples of mutually beneficial agreements exist. Mozambique's major export earner is shrimp, produced largely by joint venture ships. The country also earns foreign currency from fishery licences to foreign fleets. Shrimp and tuna fishing figure largely in international agreements as do squid and sardine harvesting. In Papua New Guinea, foreign tuna vessels must pay a bounty to local artisanal fishing communities as well as a licence fee to the government. Some countries like Indonesia have largely replaced foreign joint venture fleets with local domestic enterprises to continue the tuna and shrimp fisheries. Other areas rely heavily on foreign fleets for harvesting. Off West Africa, 60 per cent of the fish catch is taken by vessels from non-African countries.

The advent of the new EEZ regime has not brought immediate benefits to coastal states. Some developing states have lost fishing grounds which their fleets formerly harvested. But overall, the new situation has brought a challenge and stimulated fisheries development. The states which have perhaps been challenged most are the small oceanic countries. Few of them have the population to support a large fishing industry so they have to develop both offshore fleets and modern processing facilities at the same time, to tap the export market.

There still exist some high seas fisheries which take place outside the EEZ regime. But these are now reduced to around 5 per cent of all fisheries activity. The main species involved are tunas, whales, and deep water squid.

The 1984 World Conference on Fisheries Management[7/] produced a set of principles and guidelines for national management and optimum use of fish resources. The following points are worthy of note here :

"(iii) Because of the unique conditions under which fisheries are carried out and the characteristics of the new fisheries regime, governments should play a major role in fisheries management. This role includes the acquisition and dissemination of information; the formulation of objectives; the adoption of fisheries policies; and the design and implementation of management measures, and the continuous evaluation of the results.

(vi) It is important to involve all groups concerned, including administrators, scientists and fishermen, in the process of formulating and implementing management measures. Fishermen are more likely to comply with management measures when they are able to see the benefits which will arise from those measures and where they have been involved in the formulation of the measures.

(x) Governments and international organizations should take steps to prevent or abate pollution and any form of environmental degradation which may result from various aspects of economic development, thus helping to maintain fish resources in good condition, to protect critical coastal ecosystems such as mangroves and to secure the quality of fish as food.

(xi) States should co-operate in ensuring the conservation, rational management and optimum utilization of the same stock or stocks of associated species occurring within the exclusive economic zones of two or more coastal States or occurring both within exclusive economic zones and in adjacent areas on the high seas, in accordance with the United Nations Convention on the Law of the Sea in particular with respect to its provisions on the role of regional fisheries organizations. Similar co-operation should be extended in relation to the resources of inland waters.

(xiv) Whenever access is granted to foreign fishing vessels, its possible impact on national fishing operations should be assessed. The relevant agreements should include provisions to facilitate co-operation aimed at protecting national operations, promoting the transfer of appropriate technologies and developing national capabilities."

[7/] Report on the FAO World Conference on Fisheries Management and Development, Rome June 27 - July 6, 1984, FAO, Rome 1984, M-43, ISBN 92-5, 102148-1, p.16-17.

2.2 Structure of fishing operations

The world's fishing industries are divided fairly clearly into artisanal and industrial sectors. The artisanal sector includes subsistance and small scale fisheries. Artisanal fishermen are mostly self-employed or work in small family or village groups. They are paid in cash or in kind on a share basis and do not receive wages as such. Industrial or commercial fisheries units are owned by businessmen or companies and are operated on a commercial basis. The fishermen or fish plant workers are employees who receive wages which may be supplemented by a small catch share or productivity bonus. Artisanal fisheries have a very low level of capital investment in contrast to industrial fisheries which are mostly capital intensive.

In terms of manpower, the artisanal fisheries employ around ten million persons worldwide as compared to half a million in the industrial fleets. A further 5 to 10 million part time fishermen assist in the artisanal operations. These figures are for the extraction or harvesting operations. Manpower figures for post harvest operations are much harder to obtain and can only be guessed at for most regions. Including women and children, there are probably 100 million persons directly dependent on the artisanal fisheries for their livelihood and around 5 to 10 million dependent on the industrial sector.

Most artisanal fishermen are located in the developing world, and the bulk of them in Asia. Nearly half of them are found in six countries: China, Republic of Korea, Indonesia, Philippines, India and Bangladesh. They use small boats and canoes, the vast majority of these small craft being powered by sail or paddle. Indonesia alone has over 200,000 sail powered fishing vessels. Artisanal fishermen utilize mainly passive methods of fish capture, hooks and lines, gill nets or traps. Their individual catches are small. Production per fisherman in many cases is less than one ton per year. But the total artisanal catch is substantial, over 25 million tons or around 45 per cent of the total production for human consumption. Hardly any of the artisanal catch goes for reduction to meal or oil. Some of the catch is consumed directly by the fishermen and their families or communities.

As they lack processing and preservation facilities, artisanal fisheries suffer a lot from spoilage. Some 10 per cent of the fresh fish and 25 per cent of dried or cured fish are lost through spoilage. The introduction of facilities and practices to reduce this waste would require some collective action or organization at the village or community level. Attempts to organize artisanal fishermen or communities into co-operatives have met with very limited success to date. Two major constraints are the strong local cultural or tribal structures and the considerable power of fish merchants.

Industrial or commercial fishing fleets generally concentrate on supplying fish for well established processing or marketing entities. Most export fish comes from industrial vessels as do practically all of the supplies for fish meal plants. The commercial fleets mostly use very active and efficient methods of fish capture such as trawl nets and purse seines. The size of the vessels can vary from under 50 tons to over 500 tons, the power from 100 hp to over 1,000 hp, and the cost from US$ 100,000 to over US$ 2,000,000.

Contrary to popular opinion, commercial vessels do not all operate in distant or deep sea fishing grounds. Many of them fish very close to shore. Shrimp trawlers, for instance, which may fish hundreds of miles from their home port, may still be fishing relatively close to land. This creates much friction and sometimes conflict between the companies owning the vessels and small scale fishermen in the localities their ships invade. Most governments have attempted to reserve inshore fishing grounds for small scale fishermen but often the legislation has no effect as the countries do not have the necessary fishery protection fleet to police the areas.

Uncontrolled growth of industrial fleets has led to stock depletion in several of the world's major fisheries and has necessitated the introduction of licensing or limited entry to restrain fishing effort. The dangerous increases in fishing power have come about in the size and sophistication of individual vessels and not just in the number of vessels in any one fleet. Licensing regulations sometimes fail because they do not prevent increases in the engine power, mechanization or electronic sophistication of licensed boats. One large modern purse seiner can take many hundreds of tons of fish in a single set of the net. Some can land over a thousand tons from one trip. That amount of fish could support a thousand artisanal fishermen for a whole year.

Not all industrial fishing vessels are a danger to fish stocks, but all do need to be controlled to prevent unfair competition with small scale fishing fleets which are not able to migrate to other areas, and to prevent over-harvesting of any particular resource. Large sophisticated vessels are required particularly for ocean fishing and to capture deep water species like mesopelagics or blue whiting, but for most purposes, within the 200 mile EEZ, vessels of moderate size are adequate. The major part of the fishing fleets of Europe and North America are made up of vessels in the 25 to 95 ton category. Some modern commercial fleets have even smaller vessels.

Artisanal and commercial fleets also differ greatly in the capital and operational costs they involve. Artisanal vessels cost only a few thousand dollars. Some canoes can be had for a few hundred dollars. The smallest commercial vessels cost in the tens of thousands, and most commercial boats are in the US$ 100,000 to US$ 1,000,00 bracket. Large ocean going trawlers and purse seiners cost several million dollars. The operating costs likewise differ. The biggest single item in the expense budget is fuel. While a tank of fuel for an artisanal boat may be US$ 10 or US$ 20, for a commercial ship it could be US$ 1,000 or US$ 2,000 or more.

Industrial vessels are very efficient in terms of manpower required as the crews on those vessels are small. They are not as efficient as artisanal boats however when it comes to energy consumption or return on capital. To produce the same amount of fish the average commercial trawler needs to consume 350 litres of fuel. For each US$ 1,000 invested in fishing boats, the commercial sector produces around half a ton of fish a year. For the same amount of capital investment, the average artisanal fleet produces about ten tons of fish.

Table 2.6. Comparison of artisanal and industrial sectors

	Industrial/commercial fishing fleets	Artisanal/small scale fishing fleets
Amount of fish caught for human consumption	32 million tons	27 million tons
Amount of fish caught for reduction to meal or oil	22 million tons	Almost none
Total number of fishemen employed	+- 500,000	Over 10 million
Capital cost of each job on fishing vessels	US$ 10,000 to US$ 100,000	US$ 100 to US$ 1,000
Total fuel consumption	10 to 15 million tons	About 1.5 million tons
Amount of fish caught for each ton of fuel consumed	2 to 5 tons	10 to 20 tons
Number of fishermen employed for each US$ million invested	10 to 100	1,000 to 10,000
Amount of fish produced for each US$ million invested	400 to 4,000* tons	5,000 to 15,000 tons

* The higher figure applies only to a few large purse seining vessels working for reduction plants.

Source: Based on 1984 production figures. Fuel and capital estimates based on selected studies including : ICLARM, MANILLA 3.3. 1980 and WEBER, FONTANA, DAKAR, COURIER 85 1984

The 1984 FAO World Conference on Fisheries Management and Development took special note of the role of small scale fisheries and the human or social dimension to their problems. The conference advised that :

> "(ii) As a rule, the interest of the national economy may demand simultaneous and harmonised development of both small-scale and industrial fisheries. There is a need for a well-defined overall strategy, based on economic, social, biological and other factors, clarifying the role to be played by each type of fisheries."

The conference also noted the special nature of the artisanal sector and recommended that :

"(i) Since the problems of rural fishing and fish-farming communities are not related solely to fish production, the development of this sector can often be best approached within the context of integrated rural development. The principles adopted by the World Conference on Agrarian Reform and Rural Development should therefore find wide application in small-scale fisheries and aquaculture development.

(vi) Education and training and other forms of social investment should be made an essential part of small-scale fisheries development. More extension workers should be trained within cooperatives and small-scale fishing communities, in particular in fisheries technology, social welfare and community development and in the management and operation of small-scale enterprises and organizations. The link between extension and practical research should be strengthened. Due consideration should be given to the special role of small-scale fisheries in the economies of island States where they are often the major source of employment and foreign exchange earnings.

(vii) Active participation of small-scale fishing communities in the planning and formulation of development activities should be encouraged so as to ensure their successful implementation. To achieve these aims, it would be useful to provide such participation in some countries through coordinating bodies such as councils or unions of cooperatives.

(xi) The adaptation and modification of locally developed methods and equipment for use in small-scale fisheries should be carefully considered before directly transferring technologies developed elsewhere, especially the introduction of capital-intensive technology.

(xii) Attention should be given to making available credit facilities to small-scale fishermen on terms and conditions in keeping with their generally weak economic positions and special needs.

(xiv) New and better methods of evaluating small-scale fisheries activities should be devised, taking into consideration not only technical and economic but also less easily measurable factors such as amenities of life, health, education and communications."

2.3 Disposition of world catch

Of the total world fish catch of 85 million tons (1985), 72 per cent is used for human consumption and 28 per cent for reduction to meal and oil. Of the 61 million tons for human consumption, 29 per cent is marketed fresh, 33 percent is frozen, 20 per cent is cured (dried, smoked or salted), and 18 per cent is canned. The relative proportions of each have changed little in recent years apart from the growth in the supply of frozen as opposed to fresh fish.

Developing countries take about 45-48 per cent of the total world catch and there is surprisingly little difference in the proportions used for processing and for reduction to meal and oil. The developed countries have a much higher use of freezing to preserve the catch while developing countries concentrate on curing which requires very little capital investment. Freezing plants and canning factories in developing countries are mostly geared to satisfy the export market.

There are two major areas of contrast in fish supplies for developing and developed countries. The first is the relative sizes of the supply and population. While total fish food supplies are similar for each (29.9 million tons developed, 25.8 million tons developing), the populations to be fed differ greatly (1.17 billion developed and 3.35 billion developing). Therefore the overall average per capita supply of fish food is 25.4 kg for developed countries but only 7.7 kg for developing countries.

The second major contrast lies in the amount of fish lost through spoilage. This is estimated to be 1.7 million tons from fresh fish and 3.05 million tons from cured fish. The figures are much smaller from frozen and canned fish. As most of the fresh fish and cured fish trade takes place in the developing world, the bulk of the spoilage loss of about 5 million tons also takes place there. Considerable work has taken place to establish ice plants and sanitary premises for the storage and sale of fish but greater efforts are needed in this area if spoilage is to be reduced significantly.

Table 2.7. Fish production and food supply, average 1980-1982

	Developed countries	Developing countries
Production (000's MT)	39,000	35,500
Non-food use	10,300	9,100
Imports	8,600	2,900
Exports	7,400	3,500
Food supply	29,900	25,800
Population (million)	1,177	3,353
Per capita fish (kg) food supply	25.4	7.7

Source: FAO, Yearbook of fishery statistics, Fisheries commodities 1984.

While fresh fish markets handle a great variety of species, the processing industry tends to concentrate on a few. The three major processed groups are tuna, shrimp and small pelagics (sardines, herring, mackerel). The fish meal industry also uses chiefly small pelagics, the oilier fish being preferred for their greater yield of oil without which the meal is only marginally profitable.

Frozen fish continues to be produced in large quantities in the developed countries but there is a definite shift of canning activity from developed to developing countries where labour costs are lower. The U.S. tuna industry is gradually having to rely more on foreign based canneries. So much lower are their operating costs, that some canneries in the developing world are able to purchase supplies from Europe or North America and sell the processed product back to those regions. This happens during months when local fish supplies are inadequate.

The handling of fish at sea has seen steady improvements in the form of gutting, icing, boxing, cooling and freezing of the catch. Refrigerated sea water tanks have greatly improved the quality of bulk fish taken at sea. Some of these improvements have been simplified and introduced to artisanal fisheries with good effect.

The processing of fish at sea on factory ships takes place only in the very distant water fisheries such as the North Pacific. With the extension of fishing limits to 200 miles, there are few locations where factory ships can operate without some kind of licence arrangement with the host country. Many factory ships now purchase fish catches from local fishing fleets instead of utilizing fish from their own national fleet. This happens in the N.E. Atlantic where so called klondykers from the USSR and East Europe buy herring or mackerel from Scottish vessels, and in the N.E. Pacific where Soviet and Japanese ships purchase fish from American vessels.

Ocean going tuna and shrimp vessels only freeze their catches. The processing takes place on shore after the frozen fish have been landed to a shrimp plant or tuna canning factory. Portuguese and Spanish vessels fishing for cod in the N.W. Atlantic used to split and salt the fish on board, but this practice has largely given way to freezing.

Each year some 5-15 million tons of edible fish are dumped at sea by shrimp trawlers. This by-catch would form a very useful addition to the world fish food supply if it could be saved and utilized. It is made up of a large variety of demersal fishes of mixed value, and the major problems in its utilization are economic rather than technical. Shrimp trawlers are designed to produce frozen shrimp exclusively. There is not space on board for stowing or processing the bigger quantities of cheaper fish. Neither is the crew large enough to cope with the work involved. Several governments have taken steps to make shrimp trawlers bring back at least some of the by-catch, but generally they have met with lack of enthusiasm or poor co-operation from the companies.

It would probably be best in the interim period (before designing and constructing ships which could handle both fish and shrimp economically) to have the by-catch transferred at sea to vessels which would be equipped to process and stow them on board. This alternative also has its difficulties both in communication and transfer at sea, and in the kind of process to use. The vessels could use removable cod-ends clipped to trash chutes on the trawlers and picked up from the surface. The chief options for processing are simply freezing the fish, mincing it into a kind of surimi, or making fish silage in tanks with organic acid. The technology already exists for all of these processes, but the economies of operation and marketing need to be worked out in each case. Another possibility would be to have the by-catch collected at sea by artisanal fishermen assisted for navigation and safety purposes by some kind of mothership or supervision vessel.

The discharging of fish from vessels and handling of catches in markets and landing places merits attention. Much of the deterioration in quality from capture to sale can be blamed on time consuming procedures and inadequate facilities. This is particularly true in developing countries whose fisheries suffer a lot from post harvest spoilage. The introduction of simple but effective measures could reduce much of the deterioration. These include speedier unloading, sale and transport, and the provision of ice, clean water and sanitary, shaded reception halls.

If the world fish catch is to increase as hoped to over 100 million tons by the end of the century, greater use will have to be made of species not currently harvested because of their inaccessibility or low meat yield. Apart from their use to make fish meal or protein concentrate, one answer to their utilization must be the growing "surimi" market. This is a minced fish product which has a wide range of applications such as in fish sausage, fish paste, and artificial 'crab' sticks, 'shrimp' tails or 'scallops'. The Japanese use mostly Alaska pollock, croaker or sharp toothed eel to make surimi. Experiments are going on in the north Atlantic with deep water blue whiting, Norway pout and other less utilized species.

Artisanally cured fish forms the bulk of processed fish in the developing world. The raw material is cleaned, salted, sun dried and smoked, but a substantial amount is lost by spoilage during the process. Fly and beetle infestation are the main causes of spoilage. As with fresh fish handling, the remedies are simple and relatively low cost. Proper drying racks, fly screens, plastic solar driers, good salt, clean water and hygienic premises would eliminate most of the spoilage. To obtain and operate improved facilities, the traditional fish curers need some technical assistance and possible organization into co-operatives or producer associations.

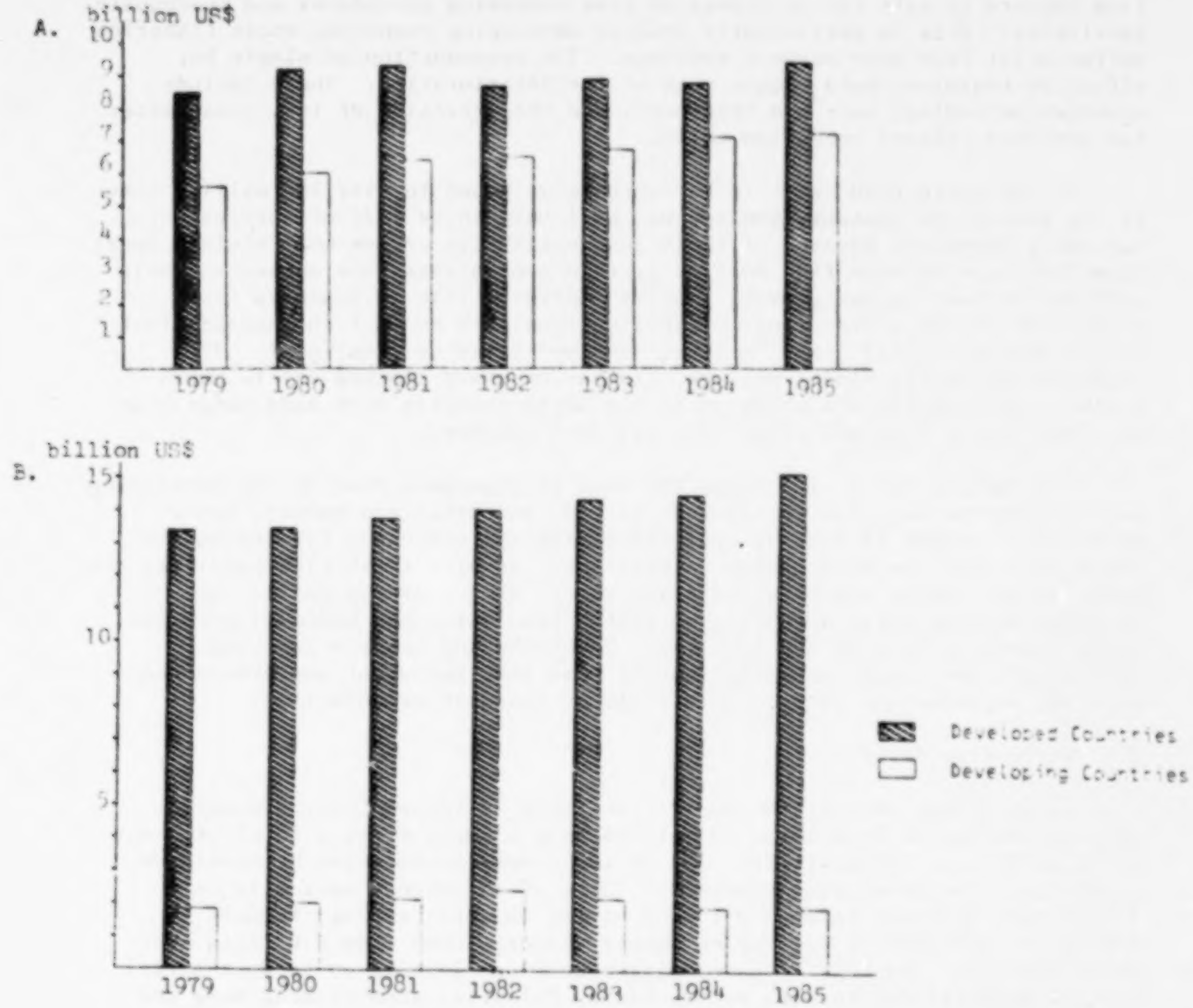
2.4 World fish trade

About 15 per cent of the world fish catch is traded internationally. This amount varies from 10 to 13 million tons a year, worth a total of about 14 to 17 billion dollars. The bulk of the trade is conducted by developed countries. The developing countries' share of the export market is only 32 per cent and they take 25 per cent of the imports (average figures 1980-82). The bulk of developing country exports come from S.E. Asia and South America. The bulk of developing countries' imports go to West Africa (mainly Nigeria) and to S.E. Asia (chiefly Malaysia, area of Hong Kong and Singapore).

The three largest import markets are Europe, Japan and the United States which together take in value about 77 per cent of all traded fish products. Many developing countries are net importers of fish, particularly the area of Hong Kong, Nigeria, Egypt, Saudi Arabia, Congo and Colombia.

The largest exporters are also developed countries. Between them, Canada, United States, Norway, Denmark and Japan command 30 per cent of the fish export market. Among developing countries, the biggest exporters are the Republic of Korea, Thailand, Mexico, Chile, India, China, Ecuador, Peru, Morocco and Indonesia. In terms of value, the largest item in international trade is frozen fish, followed by frozen shrimps and molluscs, canned fish, meal and oil, cured fish and dried, pickled or canned shellfish.

Figure 2.3. World fishery exports (A) and imports (B), 1979-1985

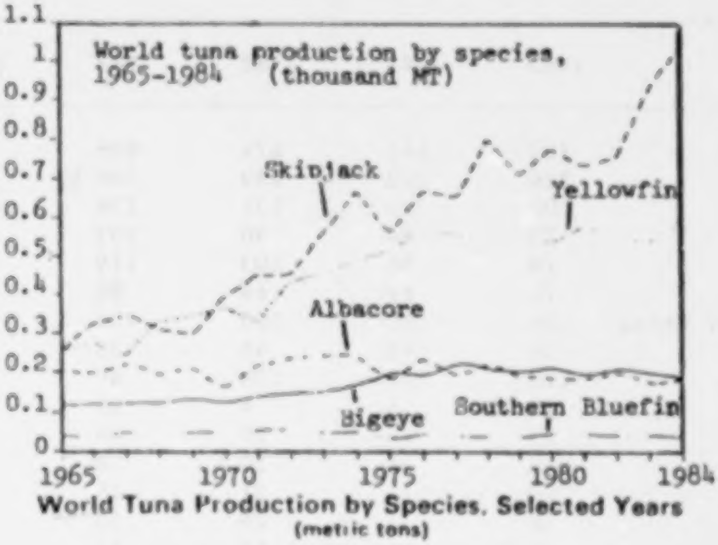


Source: FAO fisheries circular

2.4.1 Tuna

While the world shrimp markets have been fairly steady and are likely to continue to expand, the world tuna market has gone through a difficult period and has not yet recovered to the buoyant state it enjoyed in the 1960s and early 1970s. In the past the tuna trade has been dominated by Japan and the United States, both large producers and consumers, Japan being the biggest tuna producer by far, and the United States being the largest consumer. The European market for canned tuna has been growing steadily in the past few years and production by developing countries has been increasing, particularly in S.E. Asia and Latin America. Tuna harvesting activities by the United States, Japan and France were seriously affected by both the fuel price rises of the 1970's and the new regime of exclusive economic zones which followed shortly after.

Figure 2.4. World tuna production by species, selected years



Source: FAO FISHDAB

Table 2.8. World tuna production by species, 1980-1984 (thousand metric tons)

	1980	1981	1982	1983	1984
Skipjack	780	740	780	910	1,050
Yellowfin	540	590	570	590	600
Albacore	190	180	200	170	170
Bigeye	220	200	220	220	210
Southern bluefin	50	50	40	50	40
Northern bluefin	30	50	50	40	40
Total	1,810	1,810	1,860	1,980	2,110

Source: FAO FISHDAB

Table 2.9. World tuna production by major tuna-fishing nations[a], 1980-1984 (thousand metric tons, live weight)

	1980	1981	1982	1983	1984
Japan	723	642	674	696	788
United States	226	222	199	266 b/	263
Spain	101	122	131	126	132
Indonesia	73	84	90	103	115
Philippines	79	95	103	119	104
France	72	69	69	84	100
Taiwan Province of China	106	90	104	104	99
Mexico	34	68	45	38	78
Republic of Korea	110	105	108	89	71
Venezuela	4	6	4	39	53
Solomon Islands	23	26	20	34	36
Maldives	28	26	20	26	32
Ecuador	19	19	21	15	29
Ghana	9	15	29	33	22
Brazil	10	24	17	17	22
Panama	21	16	25	14	20
Sri Lanka	20	21	22	23	18
Australia	14	18	21	22	16
Others	124	119	109	98	101
Total	1,796	1,787	1,811	1,946	2,099

a/ Including albacore, yellowfin, skipjack, bigeye and bluefin tuna only.

b/ Revised figure.

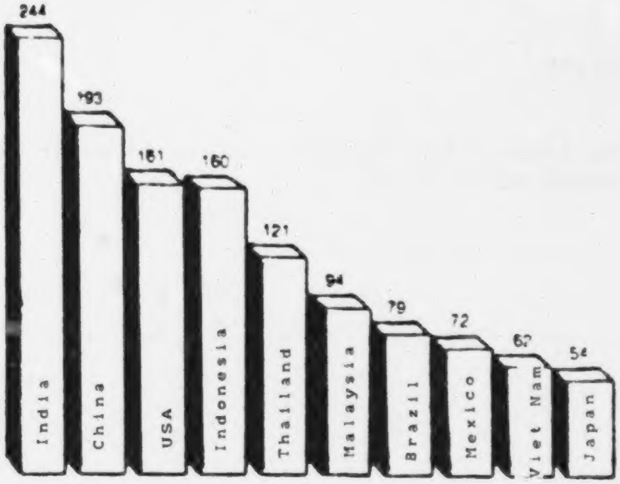
Source: FAO FISHDAB

2.4.2 Shrimp

The shrimp trade has not been beset with fluctuations in production or in the markets as has the tuna industry. The picture is one of steady growth in both areas. While most fishing grounds are already well exploited, there is a significant and growing shrimp culture industry. The three main shrimp markets, Japan, United States and Europe, have all expanded significantly in recent years. While all three regions are big shrimp producers, and particularly the United States, they each import about 150,000 tons a year. There is a tendency now for the United States to be supplied by Latin America, Japan by S.E. Asia, and Europe by Africa. The major developing country producers of shrimp are India, China, Indonesia, Thailand, Malaysia, Brazil and Mexico.

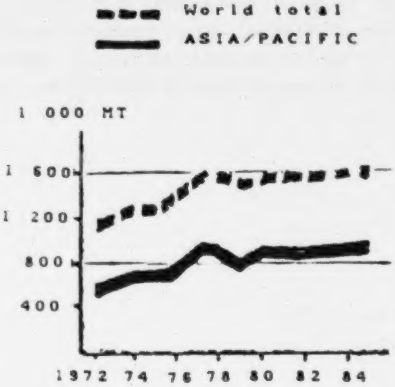
For a long time, developing countries encountered problems in exploiting shrimp due to the strict quality requirements of the United States and Japanese markets. This in turn forced producer countries to improve their hygiene standards and practices in processing plants and on vessels. Exports to Europe are controlled by severe regulations and attitude of the importing country. However, as there is free movement of produce within the Common Market, exporters have been able to gain access through agents in less strict countries and have the consignments transported from there to the country of destination.

Figure 2.5. Major shrimp producers, 1981
(thousand metric tons)



Source: INFOFISH

Figure 2.6. World production of shrimp, 1972-1984



Source: INFOFISH

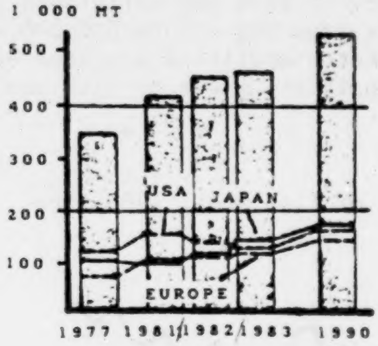
Table 2.10. Shrimp imports (all types) into the 15 major markets, 1977-1983 (thousand metric tons)

	1977	1981	1982	1983
Japan	126	165	154	149
United States	103	101	123	155
United Kingdom	12	24	28	17
France	19	28	31	32
Area of Hong Kong	16	17	24	24
Canada	11	10	10	13
Spain	7	9	14	13
Germany, Federal Republic	7	9	10	6
Sweden	12	11	14	14
Netherlands	9	15	14	12
Belgium/Luxembourg	7	9	9	10
Italy	3	7	11	11
Australia	6	6	7	8[a]
Switzerland	1	1	1	n.a.
Singapore	4	5	7	n.a.
Total	343	417	457	464

[a] 1982/1983 (1981/1982 imports were 7,464 metric tons).

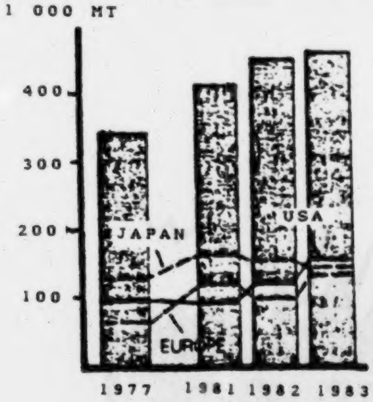
Source: FAO FISHDAB

Figure 2.7. Total expected imports of shrimp of 15 major countries in 1990



Source: INFOFISH

Figure 2.8. Total imports of shrimp of 15 major importing countries, 1977-1983

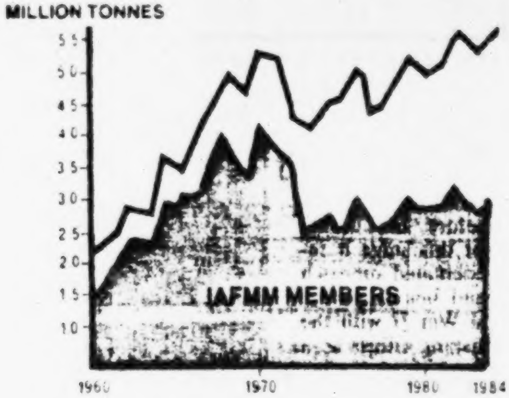


Source: FAO FISHDAB

2.4.3 Fish meal

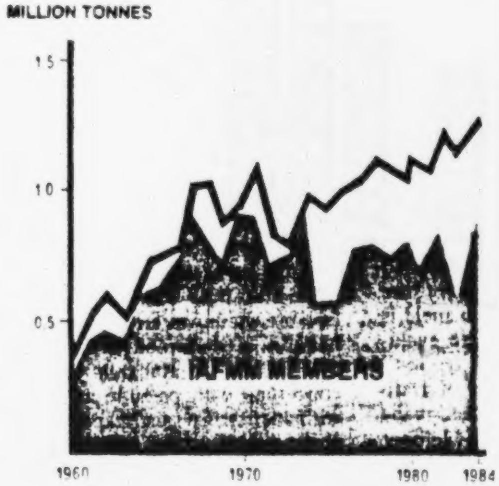
In 1984, the world produced about 5.9 million tons of fish meal and 1.5 million tons of fish oil, this from 22 million tons of fish raw material. Just over 40 per cent of the fish meal was exported, and just over 60 per cent of the oil. Production has fluctuated wildly chiefly as a result of the collapse of the anchovy fishery of Peru and variations in other pelagic stocks. Fish meal now fetches from US$ 400 to US$ 500 a ton and fish oil slightly less. The chief market competitors are soya bean meal and soya oil. While soya meal is less than half the price of fish meal, soya oil fetches a higher price than fish oil.

Figure 2.9. World production of fish meal, 1960-1984



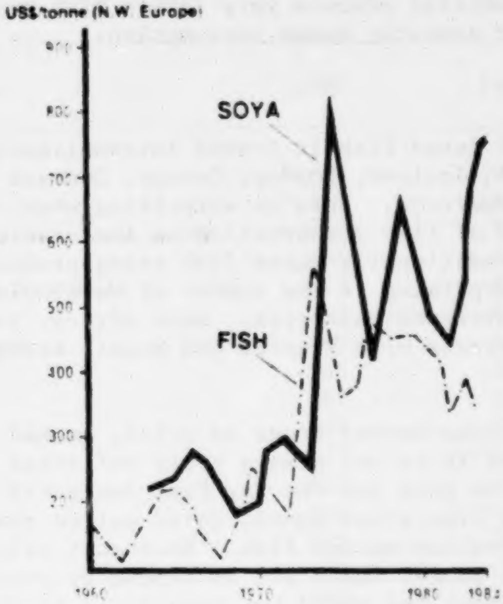
Source: INFOFISH

Figure 2.10. World production of fish body oil, 1960-1984



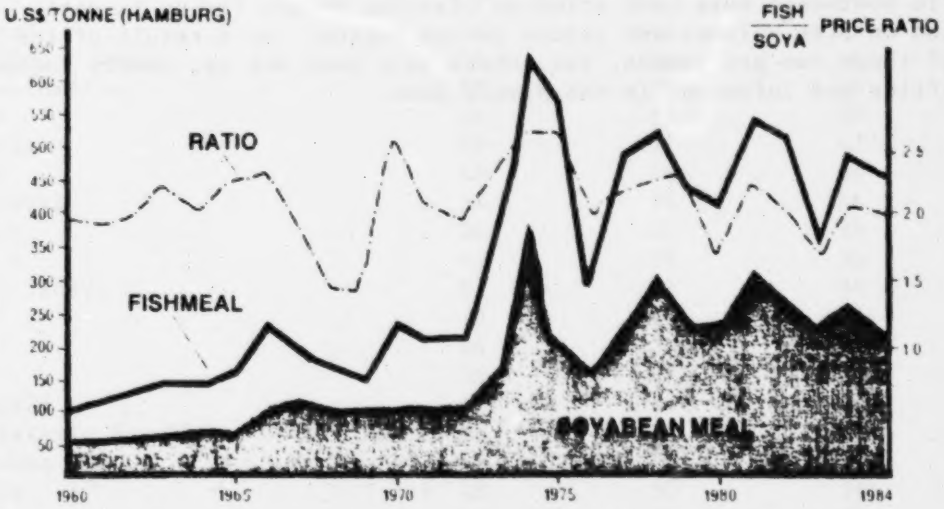
Source: INFOFISH

Figure 2.11. Prices of fish oil and soyabean oil, 1960-1984



Source: INFOFISH

Figure 2.12. Prices of fish meal (65%) and soyabean meal (44%), 1960-1984



Source: INFOFISH

The main developing country producers of fish meal are Peru, Chile, Ecuador in South America; Namibia, Mauritania in Africa and Democratic Yemen. Apart from Thailand, Asian countries produce very little fish meal as they require most of their fish for domestic human consumption.

2.4.4 Cured fish

Less than ten per cent of cured fish is traded internationally, and most of that by developed countries, Iceland, Norway, Canada, Denmark and the Netherlands being the chief exporters. This is surprising when one considers that drying is the main method of fish preservation in the developing world, with over 7 million tons of traditionally cured fish being produced for domestic consumption. More surprising is the number of developing countries that import cured fish from developed countries. West Africa, the Caribbean and South America are major markets with Nigeria and Brazil being major importers.

There is a considerable cross-border trade in dried, smoked and salted fish between African states but it is not always truly reflected in official statistics. Cured fish trade in Asia and the Far East concentrates more on somewhat higher value products like dried squid, dried-salted shark fin, boiled-dried shrimp and dried-salted marine fish. Southeast Asia is also a major source of fermented fish sauces which are in demand by people of Chinese and oriental extraction throughout the world but especially in the west coast United States.

Mention should be made of the growing trade in ornamental products made from shells and corals. This, normally a cottage industry, produces many millions of dollars of export items and provides work for thousands of women and young people in fishing communities.

The FAO regional fish marketing programmes have been of major benefit to developing country trade in fish products. Infopesca in Latin America and Infofish in Southeast Asia have acted as clearing houses for up to date information on fish volumes and prices in the region. As a result of the success of these two programmes, two others have been set up, namely Infopeche in West Africa and Infosamak in the Middle East.

Table 2.11. International trade in fishery commodities by principal importers and exporters, 1982-1985 (million US$)

A. Imports

Country or area	1982	1983	1984	1985
Japan	3,974	3,947	4,143	4,588
United States	3,175	3,621	3,702	3,822
France	1,036	1,050	976	929
United Kingdom	885	911	877	994
Germany Federal Republic	823	831	801	795
Italy	753	736	742	790
Area of Hong Kong	469	440	440	441
Spain	526	399	390	348
Canada	281	336	373	327
Denmark	298	310	327	373
Belgium	327	319	297	...
Netherlands	310	272	288	314
Sweden	268	261	257	245
Australia	221	200	228	235
Singapore	184	200	224	193
Switzerland	193	194	189	...
Portugal	182	140	139	165
Nigeria	358	280	138	121
USSR	71	133	138	...
Malaysia	100	89	108	108
South Africa	76	97	106	67
Finland	95	94	88	...
Greece	88	68	85	...
Egypt	67	81	81	81
Saudi Arabia	93	79	74	...
Austria	73	77	69	...
Thailand	28	42	67	...
Republic of Korea	56	56	66	90
Czechoslovakia	89	78	56	...
Poland	34	53	50	...
Colombia	84	47	47	...
Norway	48	48	46	...
Yugoslavia	54	74	46	...
Hungary	34	41	39	...
Ireland	42	38	35	...
Côte d'Ivoire	81	70	34	36
Brazil	77	43	34	34
Israel	26	34	33	29
Cuba	35	37	32	...
Indonesia	45	33	28	...
Iran Islamic Republic	38	32	28	...
Sri Lanka	16	16	25	...
Romania	28	30	24	...
Algeria	13	20	23	...
Papua New Guinea	29	22	22	...
New Zealand	21	20	20	21
French Guiana	20	27	19	...
Jamaica	29	24	19	...
Congo	23	14	19	...
Others	150	159	190	...
50 countries or areas	16,028	16,218	16,284	...
World	16,632	16,680	16,670	17,381

Table 2.11. (continued)

B. Exports

Country or area	1982	1983	1984	1985
Canada	1,300	1,277	1,237	1,312
United States	1,032	997	924	1,170
Norway	888	978	903	975
Denmark	901	928	899	930
Japan	801	788	882	853
Republic of Korea	758	735	777	767
Thailand	482	545	633	585
Iceland	539	527	509	581
Netherlands	504	511	501	530
Mexico	396	437	468	423
Chile	386	419	419	426
Australia	314	322	346	305
India	355	352	331	345
Spain	289	280	308	336
China	314	282	304	324
USSR	218	324	304	...
United Kingdom	289	312	302	341
Germany Federal Republic	316	306	296	279
France	293	316	294	...
New Zealand	191	207	255	306
Area of Hong Kong	217	210	236	270
Indonesia	232	235	229	225
Ecuador	219	218	219	243
Peru	289	144	213	236
Morocco	155	199	204	210
Brazil	162	137	178	167
Singapore	139	152	164	161
Cuba	146	158	158	...
Senegal	145	137	151	...
Argentina	184	181	150	148
Mauritania	93	160	148	...
Faeroe Islands	142	166	149	158
Philippines	120	134	117	...
Italy	101	105	105	...
Greenland	104	116	102	...
Malaysia	118	104	99	...
South Africa	94	103	94	82
Poland	88	84	93	...
Portugal	91	91	92	95
Belgium	73	87	87	...
Ireland	99	98	87	...
Panama	69	73	86	...
Sweden	90	89	85	...
Bangladesh	46	68	80	...
Pakistan	79	68	79	...
Venezuela	24	55	77	...
Viet Nam	45	45	65	...
Turkey	47	43	60	...
Côte d'Ivoire	48	56	49	...
Others	540	651	672	...
50 countries or areas	14,566	15,009	15,219	...
World	15,324	15,756	15,957	...

Source: FAO

2.5 Consumption

Fish resources form a significant part of human nutritional supplies, and in many parts of the developing world they are the major source of protein. Although in many developing countries the per capita consumption of fish is low, it still forms a large part of total animal protein intake. If ranked in order of percentage use of fish in animal protein supplies, the first 40 states in the list are developing countries, with the exception of Japan. (James, FAO 1984)

In many developing countries, particularly in Africa, a considerable increase in supply is needed to meet nutritional needs. If present global per capita consumption was to be maintained, and allowance made for population increase, an increase of 19 million tons would be required by the year 2000 (FAO 1984 estimate). An allowance for a modest growth in consumer income would require some 10 million tons more. The bulk of this increase will be required by developing countries who account for 74 per cent of the present world population and would provide 90 per cent of the anticipated increase in population.

A study of the 34 countries in table 2.13 with less than 5 kg per capita fish consumption would indicate several underlying reasons for the low consumption: (a) low production or lack of fish resources; (b) low incomes resulting in poor markets for all protein foods; (c) plentiful supply of meat or alternative protein; (d) cultural food preferences or traditional unfamiliarity with fish; (e) population scattered in inland regions, making fish distribution difficult and expensive.

Increases in production will not of themselves result in increased consumption except in those countries with well established marketing and distribution infrastructure, and large or buoyant domestic markets. Marketing and production need to be developed together in co-ordination and linked in some cases to educational or nutritional programmes.

There have been a number of successful programmes with both educational and nutritional elements which have boosted consumption among target groups, chiefly the young and the low income groups. Often these programmes have cost very little in terms of money, equipment or personnel. An Irish Fisheries Committee sponsored fish cooking competitions in schools with excellent results. This scheme was later copied and adopted by the then U.K. White Fish Authority. Many schools in the Far East operate fish ponds which are managed largely by pupils. The fish, when harvested, are used in the school canteen in meals for the students. Nutritional schemes for millions of school children, families and factory workers in South America have successfully utilized new fish products from less marketable species (see table 2.12). A new and promising method of promoting fish among housewives is the use of focus groups chaired by extension workers. This approach was developped at Cornell University and sponsored by Mid-Atlantic Fisheries, United States.

There are large quantities of deep water fish which can now be harvested but which cannot be marketed in their natural form. They could be turned into fish protein concentrate (FPC). This protein flour, a very refined form of fish meal, was thought to have great potential for human nutrition, but early marketing trials were unsuccessful if not wholly disastrous. In retrospect most experts believe that the failure lay in insufficient attention to the attitudes and preferences of consumers and inadequate effort to produce a truly palatable and attractive product. FPC was originally produced in two forms, type A which was more purified but too expensive, and type B which was less palatable. Efforts could be made to make FPC suit the preferences and palates of the target population. It could then be spread on any starch base - rice, bread, maize porridge or cassava as the people would normally do with their small quantities of vegetable, meat or fish.

Some new and interesting FPC derivatives are now available. One of these is 'marinbeef', a meat-textured product which can be made to resemble mince, curry, hamburger, meat loaf or steak in form, colour, taste and smell. Marinbeef is made from an FPC derived from the flesh of the raw fish and not the whole fish as for most meals. It is off-white in its natural colour and has no fish smell. The protein content compares favourably with other FPC or soyabean protein concentrates. Marine beef needs to be rehydrated with water during which process it expands to five times its weight.

While FPC possibilities exist, most experts believe that the new 'surimi' technology has the greatest potential for economic utilization of waste fish, by-catches and less attractive species in the human consumption market. This minced fish product can be marketed in a variety of attractive forms.

The judicious use and marketing of these new forms of fish food could greatly improve fish consumption not only among the more affluent urban dwellers, but among low income and rural peoples many of whom require a greater protein intake.

Table 2.12. Fish consumption programmes in South America

Overview of current fish product development work

	Raw material	Product
Ecuador:		
Frozen mince	shark, small pelagics	fish sticks
D/S mince	shark	cake, sweet and salty cookies
Mince	small pelagics	hamburgers, ham, meat extends
Peru:		
Mince	small pelagics	hamburgers,"beef steak"
Marine beef	sardine, horse mackerel	meat extends and/or replacer
Functional protein powder	mackerel, sardine	supplement for noodles, cereal products, soups
Chile:		
Mince	hake, mackerel	sausage
Brazil:		
FPC/A	sardine	supplement noodles, etc

Number of beneficiaries of institutional feeding programmes (thousand)

	Ecuador	Peru	Chile	Brazil	Total
School lunches	740	3,000	824	25,000	29,564
Mother-and-child programmes	300	93	1,094	5,000	6,487
Factory and other canteens	-	40	20	3,000	3,060
Total	1,040	3,133	1,938	33,000	39,111

Source: Ruckes, Infofish 1/86.

Table 2.13. Fish supplies and consumption 1980-1982[a/]

(a) High fish consumers (more than 15 kg per capita)

Country	Production (thousand metric tons)	Net food fish supply b/ (thousand metric tons)	Population c/ (thousand)	Per capita fish supply (kilogram)
Japan	10,661	10,121	117,623	86.0
Area of Hong Kong	186	269	5,159	52.1
Norway	2,487	201	4,100	49.1
Malaysia	741	675	14,198	47.6
Denmark	1,936	235	5,121	46.0
Republic of Korea	2,246	1,686	38,668	43.6
People Dem.Rep.Korea	1,483	735	18,319	40.1
Spain	1,299	1,310	37,606	34.8
Philippines	1,677	1,657	49,561	33.4
Singapore	17	80	2,445	32.6
Sweden	258	268	8,320	32.3
Finland	141	150	4,802	31.2
Peru	2,986	532	17,758	30.0
Chile	3,292	334,236	11,295	29.6
Portugal	261	283	9,801	28.9
Senegal	223	158	5,874	26.9
United Arab Emirates	67	28	1,058	26.7
USSR	9,659	6,904	267,769	25.8
France	774	1,314	54,179	24.3
Namibia	32	32	1,387	22.8
Canada	1,389	521	24,364	21.4
Thailand	1,967	959	47,492	20.2
Côte d'Ivoire	83	165	8,551	19.3
Oceania, (developing)	125	102	5,279	19.3
Sierra Leone	51	65	3,353	19.3
Ghana	231	223	11,837	18.9
Belgium	48	194	10,223	18.9
Cuba	182	183	9,789	18.7
Oman	84	19	1,028	18.5
Yemen Democratic	79	34	1,907	17.9
United Kingdom	881	983	56,252	17.5
Jamaica	8	38	2,198	17.4
Greece	101	166	9,721	17.1
Mauritania	47	28	1,679	17.0
United States	3,797	3,822	230,000	16.6
Nigeria	496	1,355	83,331	16.3
Poland	625	583	35,902	16.2
Ireland	184	56	3,439	16.2
Liberia	13	30	1,932	15.8
Israel	25	61	3,951	15.3

a/ Average.
b/ Production less animal feed plus imports.
c/ Excluding countries of less than 1 million population.

Table 2.13. (continued)

(b) Low fish consumers (less than 5 kg per capita)

Country	Production (thousand metric tons)	Net food fish supply b/ (thousand metric tons)	Population c/ (thousand)	Per capita fish supply (kilogram)
Afghanistan	2	2	14,489	0.1
Ethiopia	4	4	32,775	0.1
Rwanda	1	1	5,324	0.2
Nepal	4	5	15,020	0.3
Guatemala	4	5	7,482	0.6
Mongolia	0.26	1	1,709	0.8
Nicaragua	6	2	2,826	0.9
Paraguay	3	3	3,269	1.0
Niger	8	6	5,460	1.1
Iran Islamic Republic	43	49	40,003	1.2
Honduras	6	4	3,823	1.2
Albania	4	4	2,794	1.4
Sudan	28	28	19,237	1.5
Syrian Arab Republic	4	16	9,126	1.7
Burkina Faso	7	11	6,314	1.7
El Salvador	16	10	4,939	2.1
Somalia	15	10	4,855	2.1
Pakistan	311	207	90,066	2.3
Jordan	0.04	8	3,023	2.5
Iraq	35	36	13,682	2.6
Haiti	4	18	5,955	3.0
Bolivia	5	17	5,721	3.0
Algeria	56	58	19,284	3.0
India	2,421	2,130	703,344	3.2
Yugoslavia	66	75	22,470	3.3
Burundi	13	14	4,152	3.3
Kenya	62	61	17,476	3.5
Mozambique	39	45	12,515	3.6
Lebanon	2	10	2,652	3.7
Arab Republic Yemen	16	22	5,950	3.8
Hungary	38	42	10,709	3.9
China	4,513	4,325	997,175	4.3
Colombia	81	117	26,359	4.4
Argentina	407	132	28,696	4.6

b/ Production less animal feed plus imports.
c/ Countries of less than one million not included.

Source: FAO, 1983 Yearbook 57 (F. commodities, table I, page 173).

3. DEFINING FISHERIES INDUSTRIAL SYSTEMS

3.1 Lack of focus in development programmes and projects

Because fisheries activities establish linkages with a large number of industrial sectors, the integrated development of the fisheries can promote important industrial developments in sectors such as the capital goods, (boat building, marine engineering, processing, refrigeration and ice manufacture), the food processing sector, infrastructure, fuel and power supply, among others. Hence the interest of industrial development institutions such as UNIDO in promoting a balanced development of the fisheries sector.

The following box enumerates, in a simple manner, some industrial products that belong to the fisheries industrial system and examples of industrial sectors linked to fisheries activities. The purpose of UNIDO's involvement is to assist the developing countries in the production of these and other industrial products. In order to bring some structure into the heterogeneous and large number of products and fishery-related industrial sectors, it is necessary to take a systematic approach. This study represents an attempt to describe and analyze the fisheries industrial system in such a structured way. One of the main objectives of this study is to provide a basis for defining the corresponding technical asistance requirements.

Examples of industrial components of FIS

A. Industrial inputs

1. Small, coastal (continental shelf) fisheries

- Simple fishing gears, locally made on non-industrial scale, sometimes using synthetic fibre (for twine, lines, nets and cordage);
- Fishing boats (made of wood) individually built or in small shipyards equipped with oars, sails or outboard engines.

2. Large offshore operations, up to the factory ship level

- Large fishing gears made from synthetic fibre (purse seine, trawl net);
- Fishing vessels built in shipyards using various industrial inputs, such as. metal sheets, engines, electricity generators, winches, fish finders (echo-sounders), navigation equipment, radars, etc.;
- Infrastructure requirements including port facilities for discharging catch and supply of food, fuel, water, spare parts, refrigerated storage (chilled or frozen), transport vehicle, etc.;
- Processing facilities (factories) to process fish into a variety of fish products, such as fillets (frozen and packed), canned fish, fish meal and oil;
- Other inputs like fuel, packaging material (tinplate, cartons, boxes), various equipment, testing and quality control instruments, ancillary materials (salt, oil, spices, etc.).

B. Industrial linkages

- Metallurgical industry: steel sheets, alloys (for boat building), tinplate (for fish canning);
- Engineering industry: shipyards, boat building, engines, electricity generators, navigation and electronic equipment, winches, refrigeration equipment, fish processing equipment, steam boilers, pumps, maintenance and repair, etc.;
- Chemical industries: synthetic fibre, plastics, protective paints, petrochemical products (fuel, lubricants), packaging materials (paper), plastic, coatings;
- Agro-based industries: edible oil, industrial processing of fish (canning, fish meal and oil production), package design and packaging, testing and quality control of processed products, ancillary materials and packages, production management, product development;
- Non-technical aspects: industrial planning, investment feasibility studies, general management, institution building and training.

However, usually development programmes and projects lack the necessary focus that would permit them to take into consideration intersectoral linkages so that economy-wide impacts of such activities may be fairly evaluated. Instead, they tend to concentrate on individual projects. Thus projects are funded without sufficiently assessing their upstream and downstream effects. Moreover, there is a lack of attention paid to the interdependence between the macro-economic (national economic policy) and the micro-economic aspects in project formulation and evaluation.

To be able to properly identify investments and actions required in the different sectors to promote a balanced development of the fisheries subsector and of the secondary industrial sector in general, the application of a systems approach to the planning of the fisheries sector is called for. In this way, adequate policies to support sector development can be designed.

The systems approach provides a much broader view of the sector. It recognizes the interdependence of economic and social components within and outside the sector and helps to provide the conceptual framework to analyze and evaluate these interrelationships.

It is within the context of a system approach that the present study treats the fisheries sector in developing countries as a Fisheries Industrial System or FIS.

3.2 The Fisheries Industrial System (FIS)

The FIS can be defined as a system where all the industrial resources, and consumption components related to the fisheries activities in a given country as well as the institutions and policies that affect them interact in an integrated and interdependent manner.

The relationship between the complete set of components of the FIS is, however, not a simple one consisting of the exchange of goods and services, but rather a structural one with a high degree of interdependence. This interdependency is interactive in character, so that any change occurring in one of the components tends to modify the whole in a variety of ways and to a varying extent.

The implication of this approach is that a FIS should be developed as a whole rather than by components. The notion of development is replaced by the notion of integrated development. The viability of applying the FIS approach depends however, on the feasibility of properly identifying a system's components and their interrelationships.[8]

---

[8] In order to accomplish this, a sector is first disaggregated using a top-down modelling technique. Starting with the final demand goods of the sector and the identification of their consumers (intermediate or otherwise) the upstream path of each good is traced until either an imported input or a domestic primary factor input is reached. In the process of this top-down disaggregation, the physical, financial, social and demographic flows between the upstream components can be identified.

3.3 Description of the FIS

The suggested approach requires a concrete description of the FIS. In this study the following nine components have been chosen as most appropriate for describing the system: resources, extraction/production, processing, distribution and marketing, consumption, industrial inputs, government policy, industrial organization, and the foreign sector. The analysis of the FIS is, thus, reduced to the analysis and evaluation of each of these components (appropriately disaggregated) and their linkages. The nine components are described in detail in section 3.4.

For the goals of the present study, these components cover the most important aspects of the FIS. Figure 3.1 is a graphical representation of a FIS with the 9 components and their linkages illustrated by name and component number. Such a diagram is henceforth referred to as a base diagram. It can be seen as a (simplified) structuring of the system, including inter alia all items listed in the box on page 40. The numbers in figure 3.1 refer to the FIS components enumerated in section 3.4.

3.4 The nine FIS components

The following is a description of the nine main FIS components.

1. Resource. This component describes the fish and crustacean resources available to an industrial system indicating how rich they are, how well they are managed and how they are split among marine, freshwater and aquaculture sources.

2. Extraction. Also sometimes referred to as production[9], this component describes the type, condition, management and utilization of the labour and capital (especially the vessels) used in the harvesting of the resource. Foreign participation is also an important consideration.

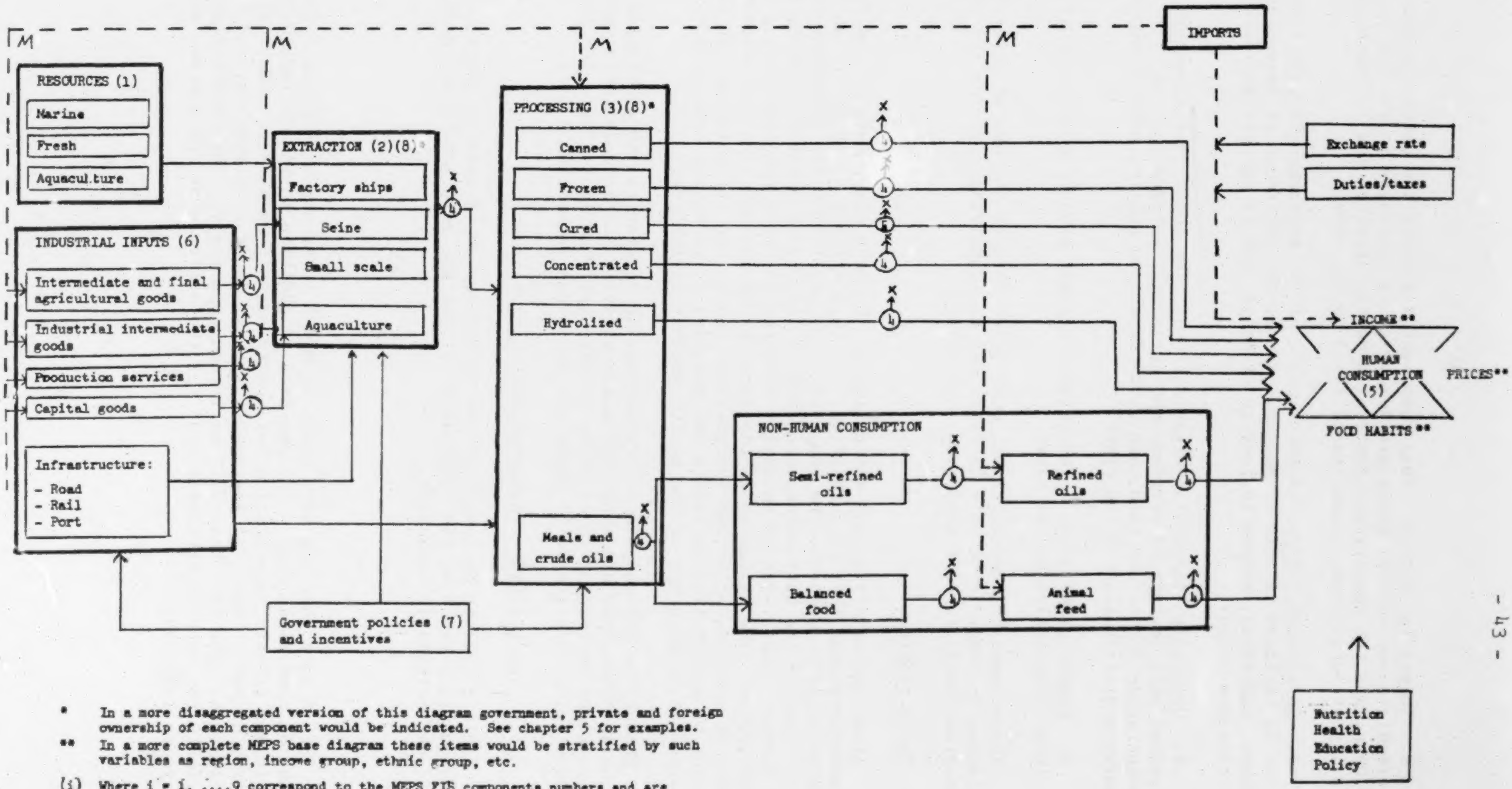
3. Processing. This component describes the type, condition, management, utilization and physical distribution of the labour, plant and equipment used in the domestic processing of extracted fish and crustaceans as well as their variable inputs and type of outputs.

4. Distribution and marketing. This component describes the channels and methods used in the distribution of outputs from each FIS component to the next downstream component. Marketing intelligence and the type of retail mechanisms present are also considered.

5. Consumption. The type, quantity, substitutability, price and income sensitivity, and desired nutritional requirements of domestic final goods demand of the system is described herein. Where appropriate, other stratifications of the distribution of consumption (e.g., income, regional) are also considered.

9/ The term production is not used in this document since it was considered ambiguous in the context of the analysis of an industrial system as a whole which has many other types of production.

Figure 3.1. Base diagram for a FIS indicating the nine components and their linkages with the rest of the economy


M
M
M
M
IMPORTS
RESOURCES (1)
Marine
Fresh
Aquaculture
INDUSTRIAL INPUTS (6)
Intermediate and final agricultural goods
Industrial intermediate goods
Production services
Capital goods
Infrastructure:
- Road
- Rail
- Port
EXTRACTION (2)(8)*
Factory ships
Seine
Small scale
Aquaculture
PROCESSING (3)(8)*
Canned
Frozen
Cured
Concentrated
Hydrolized
Meals and crude oils
NON-HUMAN CONSUMPTION
Semi-refined oils
Refined oils
Balanced food
Animal feed
Government policies (7) and incentives
Exchange rate
Duties/taxes
INCOME**
HUMAN CONSUMPTION (5)
PRICES**
FOOD HABITS**
Nutrition
Health
Education
Policy
X
(4)

* In a more disaggregated version of this diagram government, private and foreign ownership of each component would be indicated. See chapter 5 for examples.

** In a more complete MEPS base diagram these items would be stratified by such variables as region, income group, ethnic group, etc.

(i) Where i = 1, ...9 correspond to the MEPS FIS components numbers and are described in chapter 3.4

M = imports X = exports

6. Industrial inputs. This component describes the extent to which intermediate and capital goods are domestically available to the FIS on the one hand, and the quality and state of domestic services and infrastructure (e.g., port facilities, roads, rail, etc.) on the other.

7. Government policy. A description of the government's view toward the sector is included in this component. Hence, the existence of incentive schemes, subsidies, access to foreign exchange, and favourable macro-economic policies are noted.

8. Ownership (industrial organization). The industrial structure is described with respect to vertical and horizontal integration and concentration on the one hand, and with respect to public, private and foreign ownership distribution on the other.

9. Export orientation. The balance between production for export and for local consumption is described.

These component descriptions, quantified through the use of a set of variables in order to be able to carry out hard analysis, provide the common conceptual basis for all subsequent analysis.

3.5 The variables

After the selection and definition of the main components of the FIS it is necessary that they be quantified. To this effect, a set of variables has been selected to describe the important aspects of each FIS component as well as to identify the bottlenecks, constraints and development possibilities of the system. There were 63 variables selected for this purpose falling into three groups. The variables in the first group characterize the present status of the FIS, while the variables in the second and third groups identify current or potential constraints and positive or promising aspects for development in each one of the 64 FIS subject to analysis.

Though the FIS components are conceptual constructs, the variables chosen to characterize them are expressed quantitatively and in measurable terms. Their values correspond to existing or especially collected data for the 64 developing countries.[10] These are described in section 3.5.1.

3.5.1 The FIS basic characteristic variables

Table 3.1 lists by component the 21 FIS variables used to describe and hence quantify the nine FIS components. These are referred to as the FIS basic characteristic variables.

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[10] A data base has been built in order to secure a detailed appraisal of the 64 countries' FISs. Sources used in addition to FAO include both public and private organization data banks as well as a large number of country or sector-specific yearbooks, serials, pertinent reports, and experts' assessments. The data base will be issued separately. The latest figures available for each country were used for the analysis of the system, generally the years 1983-1985.

Table 3.1. The FIS characteristic variables

Component	Variables	Description
Resource	1. Raw material	The maximum sustainable yield resource of extended economic zone (EEZ) and inland waters in thousands of metric tons per annum.
	2. Resource utilization	Per cent of resource extracted. Since this is across all species, over-exploitation of certain species cannot be ruled out.
Extraction	3. Extraction throughput	Quantity extracted, harvested or produced from EEZ and inland waters in thousands of metric tons per annum. This includes foreign catch only if landed.
	4. Artisanal share of extraction	Per cent of characteristic 3 that is caught or harvested by the artisanal sector.
Processing	5. Processed share of extraction	The percentage of the landed catch which is processed (either artisanally or commercially).
Distribution and marketing	6. Sophistication of distribution channels	An assessment of the sophistication of the methods of distribution used, e.g. road, rail, and the general level of distribution infrastructure. Also important is the flexibility and reliability of the distribution chain.
	7. Sophistication of marketing methods	An assessment of the complexity and flexibility of marketing methods. Also important is the efficiency of marketing procedures.
	8. Degree of intermediation	Meant to measure the organizational "distance" between the producer and consumer. In particular the number of middlemen typically involved.
Consumption	9. Per capita consumption	The per capita apparent domestic consumption per annum.

Table 3.1. The FIS characteristic variables (continued)

Component	Variables	Description
Industrial inputs	10. Storage and handling efficiency	An assessment of the level of on-board and quayside fish loss and reduction in fish quality.
	11. Processing sophistication	Describes the processing system. This attempts to capture the proportion of the processing capacity that is high level, i.e. freezing, canning, etc. The scale of operation and level of capital intensity is also considered.
	12. Extraction inputs	A measure of the local availability of intermediate and capital goods and spare parts for extraction. Pertains to spare parts for vessels, engines and fishing gear. Where applicable, quality and size is also considered.
	13. Processing inputs	A measure of the local availability of intermediate and capital goods and spare parts for processing. Pertains to the quality of packaging materials, availability of ice, etc.
	14. Extraction services	Quality of the workforce in extraction activities.
	15. Processing services	Quality of the workforce in processing activities. (Services are also affected by availability of intermediate/ capital goods and adequate infrastructure.)
	16. Extraction infrastructure	An assessment of the quality, size and number of ports as well as the availability of repair and maintenance facilities.
	17. Processing infrastructure	An assessment of the adequacy of infrastructure in major processing areas including the reliability of public utilities, etc.
Government policy	18. Priority given to FIS	A subjective assessment of the relative importance accorded to the FIS by the national government.
	19. Assistance provided	An assessment of the importance of incentives and assistance provided directly to those working within the FIS.

Table 3.1. The FIS characteristic variables (continued)

Component	Variables	Description
Ownership	20. Role of government	Primarily, the proportion of government ownership of the FIS components but the extent of government regulations and control is also considered.
Export orientation	21. Share of catch destined for foreign markets	That percentage of the catch (measured in fresh fish weight equivalent) which is exported regardless of product form.

Note: Sources used in addition to FAO databanks, yearbooks and reports, include both a large number of country and sector-specific serials and pertinent reports reviewed and compiled by Agro-Economic Services Limited, England under contract to UNIDO, as well as UNIDO and FAO experts' assessments.

Based on data on all these variables, aggregated quantitative measures of each FIS component were constructed.11/ These are listed in table 3.2. These nine constructed, aggregated variables are used to represent each of the FIS components in the analysis of chapter 6 supporting the design of strategies and actions of chapter 7.

11/ Based on the common factor model employed in multivariate statistics, the first principal component obtained from a weighted principal components factor analysis was employed to extract from the set of 21 variables in table 3.1 a single common factor for each of the nine FIS components. Further details are given in Volume 2. See also Mulaik, S.A. (1972), The Foundations of Factor Analysis, New York, McGraw-Hill.

Table 3.2. Aggregated quantitative measures of each component describing the present status of FIS

Component	Variable constructed to measure component
Resource	Percentage of fishery resource still unexploited
Extraction	Share of harvesting (production) undertaken by artisanal sector
Processing	Percentage of catch sold as processed
Distribution and marketing	Sophistication and efficiency of marketing and distribution system
Consumption	Per capita consumption of fish
Industrial input	Degree of local availability of capital inputs and infrastructure for fisheries
Government policy (attitude)	Priority and assistance allocated to the fishing industry
Ownership	Degree of government ownership and control (versus private)
Export orientation	Share of catch exported regardless of product form (by fresh fish weight equivalent)

3.5.2 The FIS constraint variables

The second FIS group of variables represents a set of constraints to FIS development indicating the presence or absence of a particular problem. For each country, the constraint is evaluated in terms of whether it poses a current bottleneck to the FIS, therefore, the constraint is not an absolute measure of the country's FIS to be used in comparisons with other countries' systems. For example, the cold storage facilities in Kampuchea may be poor relative to Malaysia's, but since such facilities are only restricting the latter's development, it is not considered as a constraint in Kampuchea but only in Malaysia. In other words, the constraints are evaluated viewing their country as an integrated system.

In general, the constraint variables were created in three steps. First, a review of the available literature for each country suggested a preliminary list of such variables. Second, country FIS specialists were asked to comment on the correctness of their country's constraints and to make appropriate amendments. Finally, any new variables these experts suggested were evaluated for the rest of the countries.

The 27 variables describing constraints for a developing country's FIS are presented in table 3.3.

Table 3.3. A description of the 27 constraints by FIS component

FIS component	Constraint number	Description
Resource	1	Total resource is inadequate given the present size of the FIS. Additional fishing grounds need to be found.
	2	Inadequate management or policing of the resource.
	27	Highly fluctuating resource.
Extraction	3	Artisanal extraction is rudimentary and inadequate to supply the needs of the rest of the FIS.
	4	Storage and handling standards are poor. (Distribution will also be affected by this.)
Processing	5	There is a lack of processing facilities relative to the amount of fish extracted and market available.
	6	Processing standards are poor. Too much fish loss and spoilage.
Distribution and marketing	7	The distribution infrastructure is inadequate. Interior markets cannot be well served.
	8	Marketing procedures are either inefficient, inappropriate, or both. Examples are an excessive number of middlemen and traditional marketing methods no longer suited to growing or modernizing FIS.
Consumption	9	Domestic market demand is low given the ability of the FIS to deliver cost effective protein.
Industrial inputs	10	There is a general lack of intermediate and capital goods inputs locally available.
	11	There is a particular lack of spare parts domestically available.

Table 3.3. A description of the 27 constraints by FIS component (continued)

FIS component	Constraint number	Description
	12	There is a particular lack of domestically available inputs for aquaculture.
	13	There is a general lack of extraction and processing infrastructure.
	14	Repair and maintenance facilities are lacking for capital plant and equipment.
	15	There is a specific lack of ice-making capacity.
	16	Storage and cold storage facilities are lacking. (This will also adversely affect distribution.)
	17	Infrastructure for extraction and processing is congested.
	18	FIS over-capitalized given the scale of production.
	19	FIS is under-capitalized given the scale of production.
	24	General lack of skilled manpower (vis-à-vis equipment operation).
	26	There is a lack of locally available energy or fuel.
Government policy	20	A restrictive government attitude hinders investment in the FIS.
	21	Insufficient credit is available. (This is not necessarily due to government policies.)
Export orientation	22	Lack of export markets is limiting the growth of the sector.
Others	23	All components of the FIS are under-employed.
	25	Country is currently in a war zone.

Note: The constraint number is used to facilitate references to each constraint throughout the two volumes of this study.

3.5.3 The FIS enhancement variables

The third group of variables represents a set of factors which potentially could enhance a country's FIS development. They indicate the presence or absence of a particular positive factor to the development process. The enhancements were created using the same 3-step approach that was applied for identifying the constraints. As was true for the constraints, enhancements were evaluated in the context of each country's FIS as an integrated system. They reflect whether, currently, such a factor could be utilized to further the country's development given the present state of the system. Therefore, while the area of Hong Kong has better storage and handling than India, they are already fully taking advantage of it. India, however, is in a position to further exploit this positive feature of their FIS. Hence, availability of storage and handling is considered as an enhancement only for India and not for the area of Hong Kong.

There are a total of 15 variables related to enhancements of a developing country's FIS. These are described in table 3.4.

Table 3.4. A description of the 15 enhancements by FIS component

FIS component	Enhancement number	Description
Resource	1	The MSY[a/] is one and a half times larger than the amount currently extracted.
	2	Resource is being effectively managed.
Extraction	4	Operator (e.g., fishing and maritime) skills are high relative to the efficiency of the fleet.
	5	There is a high level of storage and handling efficiency.
Processing	3	Not more than half of what is extracted is being processed.
	6	Low share of commercial catch processed.
	14	Good potential for aquaculture.
Consumption	13	The share of output destined for local markets is low.

Table 3.4. A description of the 15 enhancements by FIS component (continued)

FIS component	Enhancement number	Description
Industrial input	7	Good local availability of intermediate and capital goods, services and infrastructure for extraction.
	8	Good local availability of intermediate and capital goods, services and infrastructure for processing.
	15	Abundant supply of all required energy needs.
Government policy	9	The government places a high priority on FIS development.
	10	The government provides a high level of tangible assistance to the FIS.
	11	There is a positive attitude to foreign investment which, barring exploitation, could lead to the transfer of technology and management techniques.
Ownership	12	The number of successful joint ventures suggests the potential for a transfer of technology and management skills.

Note: The enhancement number is used to facilitate references to each enhancement factor throughout the two volumes of this study.

a/ Maximum sustainable yield.

3.6 Country selection for the analysis

The choice of the 64 countries selected was based on two criteria. First, only developing countries were considered. Second, from this list, only those which had their 1983 levels of extraction in excess of 22.5 thousand metric tons were taken. Table 3.5 presents these countries by continent and figure 3.2 indicates their location.[12/]

[12/] A number of countries, notably Papua New Guinea and Costa Rica (see table 3.1) have not been included because in the year of the sample, 1983, these countries experienced a significant decline in their fisheries catch falling below the cut-off level for inclusion. Future versions of this work will take into account such annual variations in establishing the sample cut-off.

Table 3.5. The 64 selected developing countries

AFRICA

Algeria (1)
Angola (2)
Congo (3)
Egypt (4)
Gabon (5)
Ghana (6)
Cote d'Ivoire (7)
Kenya (8)
Madagascar (9)
Malawi (10)
Mali (11)
Mauritania (12)
Morocco (13)
Mozambique (14)
Namibia (15)
Nigeria (16)
Senegal (17)
Sierra Leone (18)
Somalia (19)
Sudan (20)
Tunisia (21)
Uganda (22)
United Republic of Cameroon (23)
United Republic of Tanzania (24)
Zaire (25)
Zambia (26)

ASIA

Bangladesh (27)
Burma (28)
China (29)
Democratic Kampuchea (30)
Area of Hong Kong (31)
India (32)
Indonesia (33)
Iran Islam Republic (34)
Iraq (35)
Korea, Democratic People's Republic (36)
Korea, Republic of (37)
Malaysia (38)
Maldives (39)
Oman (40)
Pakistan (41)
Philippines (42)
Saudi Arabia (43)
Sri Lanka (44)
Thailand (45)
Turkey (46)
United Arab Emirates (47)
Viet Nam (48)
Yemen, Democratic Republic (49)

LATIN AMERICA

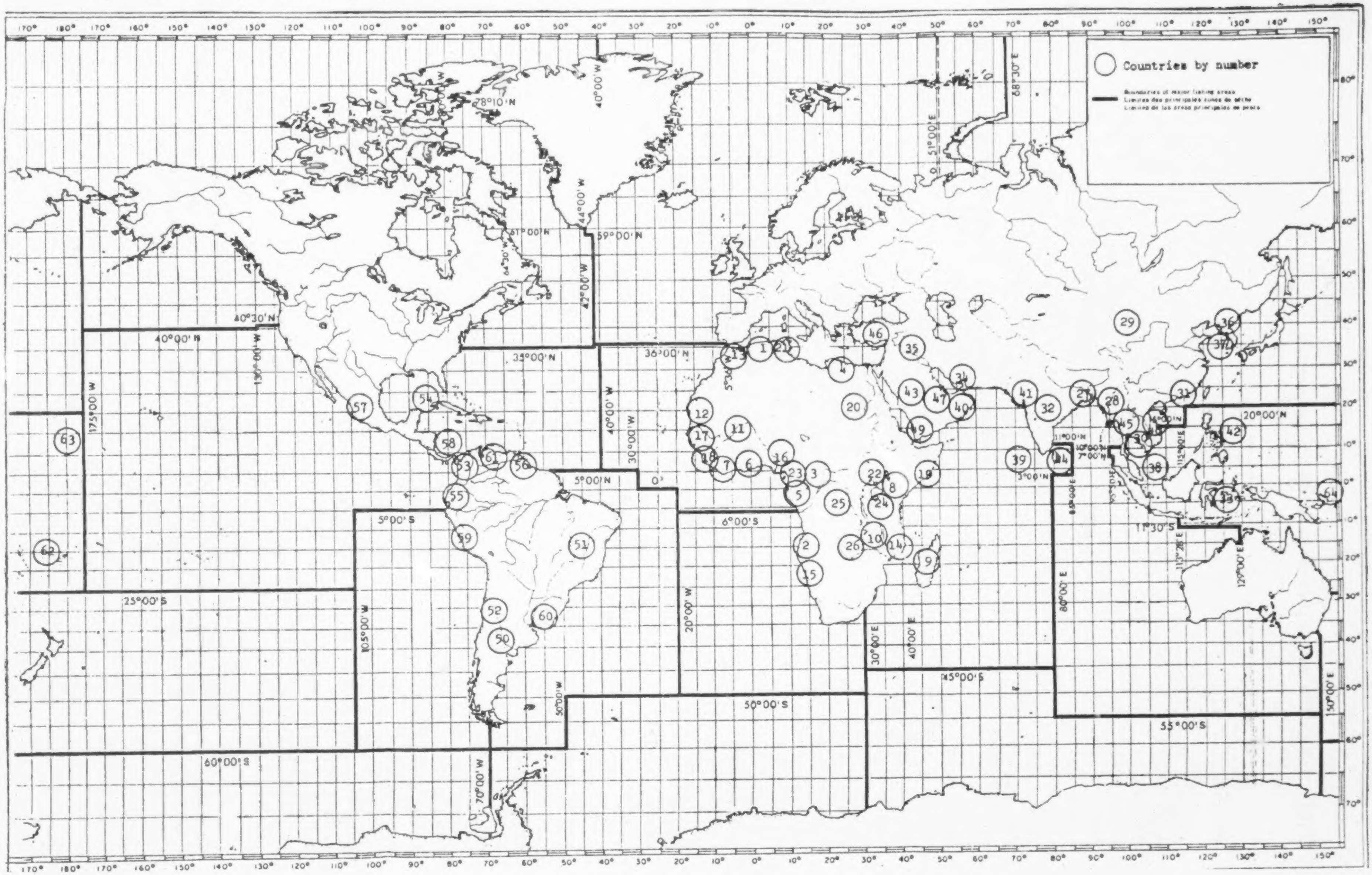
Argentina (50)
Brazil (51)
Chile (52)
Colombia (53)
Cuba (54)
Ecuador (55)
Guyana (56)
Mexico (57)
Panama Ex Cz (58)
Peru (59)
Uruguay (60)
Venezuela (61)

OCEANIA

Fiji (62)
Kiribati (63)
Solomon Islands (64)

Note: Countries with a level of catch equal or greater than 22,500 tons in 1983. FAO "Yearbook of fishery statistics, Catches and Landings", 1984. Country numbers are given in brackets and help to locate the country in figure 3.2.

Figure 3.2. Map indicating location of countries according to country number


Countries by number
Boundaries of major fishing areas
Limites des principales zones de pêche
Límites de las áreas principales de pesca
78°10'N
40°00'W
44°00'W
42°00'W
61°00'N
64°30'W
59°00'N
51°00'E
68°30'E
40°30'N
40°00'N
130°00'W
175°00'W
35°00'N
36°00'N
5°30'W
40°00'W
30°00'W
5°00'N
0°
5°00'S
6°00'S
25°00'S
105°00'W
20°00'W
50°00'W
30°00'E
40°00'E
45°00'S
50°00'S
60°00'S
70°00'W
80°00'E
85°00'E
11°00'N
10°00'N
7°00'N
3°00'N
95°30'E
112°00'E
115°00'E
20°00'N
11°30'S
113°28'E
120°00'E
150°00'E
55°00'S
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4. IDENTIFYING PATTERNS OF DEVELOPMENT

4.1 Background and objectives

This chapter aims at identifying groups of developing countries with a relatively homogeneous pattern of FIS development. Such a framework has the following objectives:

- To examine development similarities across countries and thus be able to group them according to sector characteristics rather than by geographic location as is usually done.
- To provide the basis for designing for each group pattern-specific development strategies.
- To help developing countries position themselves within the context of the developing world fisheries sector, and establish the possibility of sharing and benefitting from other countries' development experiences.
- To facilitate the design of modular technical assistance programmes.
- To give an impetus to ECDC activities in the Fisheries Industrial Sector.
- To indicate which other countries would be suitable for the repetition of particular projects already successfully implemented in a country falling into its development pattern.

The classifying of countries by continent or other regional classification when doing analysis on the sector level tends to hide more than it reveals. Within-region differences are necessarily obscured. Moreover, there is no reason why one fixed classification should provide the best insights regardless of the sector examined. Rather, the most appropriate country classification should transcend geography and focus on similarities among country characteristics of the sector being analyzed, in the present case, fisheries.

In particular, the task of identifying country development patterns can be reduced to evaluating how similar country FISs are according to a relevant set of sector characteristics. This has the added advantage that the country groupings are not imposed *ex ante* but, rather, their number, size, and membership are determined according to those considerations which, *a priori*, the experts view as most relevant.

The nine FIS components introduced in chapter 3, which together fully describe the various critical aspects of the fisheries sector in a country, provide a set of characteristics appropriate for measuring FIS similarities. As such, they were selected to serve as the basis for identifying the various distinct patterns of development among the 64 countries. A full description of the methods used is presented in Volume 2.

A sector analysis in terms of *patterns* of development based on multiple country characteristics instead of in terms of *levels* of development based on one country characteristic allows to overcome the limitation of viewing the development process in linear terms with one country more or less developed than another. This is especially important since for some characteristics the notion of more or less developed has little sense. The fisheries sector is a system when the greatest success is reached when all factors fit together functioning as a system, rather than have particularly high values.

4.2 Resulting development patterns

Following the above approach, ten country groups were identified as possessing different patterns of development. The group membership can be found in table 4.1 together with the most salient characteristics of each one. A graphic representation of the groups is given in figure 4.1[13] Any figure near zero indicates that for the countries in that group the FIS component is, on average, equal to the average of all 64 countries. These groups are described in detail below.

This figure provides a revealing view with which to compare and contrast the 10 development patterns.

4.3 Characteristics of the development patterns

The characteristics of the 10 development patterns are given in this section based on the analysis of each country group in terms of the nine FIS components. The pattern characteristics are illustrated with examples from countries in each group (please refer to figure 4.1 and appendix 1 to this chapter. Tables 1 and 2 of the appendix to this chapter give a summary result of the statistical analysis which indicates the likelihood for each development pattern (groups 1 to 10) of having a given constraint or enhancement at present or in the near future. This is done by relating the presence or absence of an attribute to the structure of each development pattern as described by the levels of the FIS components. These results were also used to describe development patterns.

Group 1: The least favoured countries

This is the largest group, of 14 countries, consisting of the least favoured states as far as fisheries and the related industrial system are concerned, lacking either the resource or the capital, skills and infrastructure to exploit their resource. Four of the countries are land-locked and have only freshwater fisheries to exploit (these were the only four land-locked countries in the whole sample). One further country has no marine fisheries zone of any significance, and three have small or less productive coastlines. That leaves six countries with significant marine fishing resources. Total production for the 14 countries is 2.9 million tons against a potential of over 4.0 million tons a year. Perhaps the most significant fact about the group is that at least 10 if not 12 of its members are producing less fish now (1983/84) than they did in past years. The level of fishery industrialization is low as a consequence mainly of their modest resources. In many cases the industrial basis is also low and

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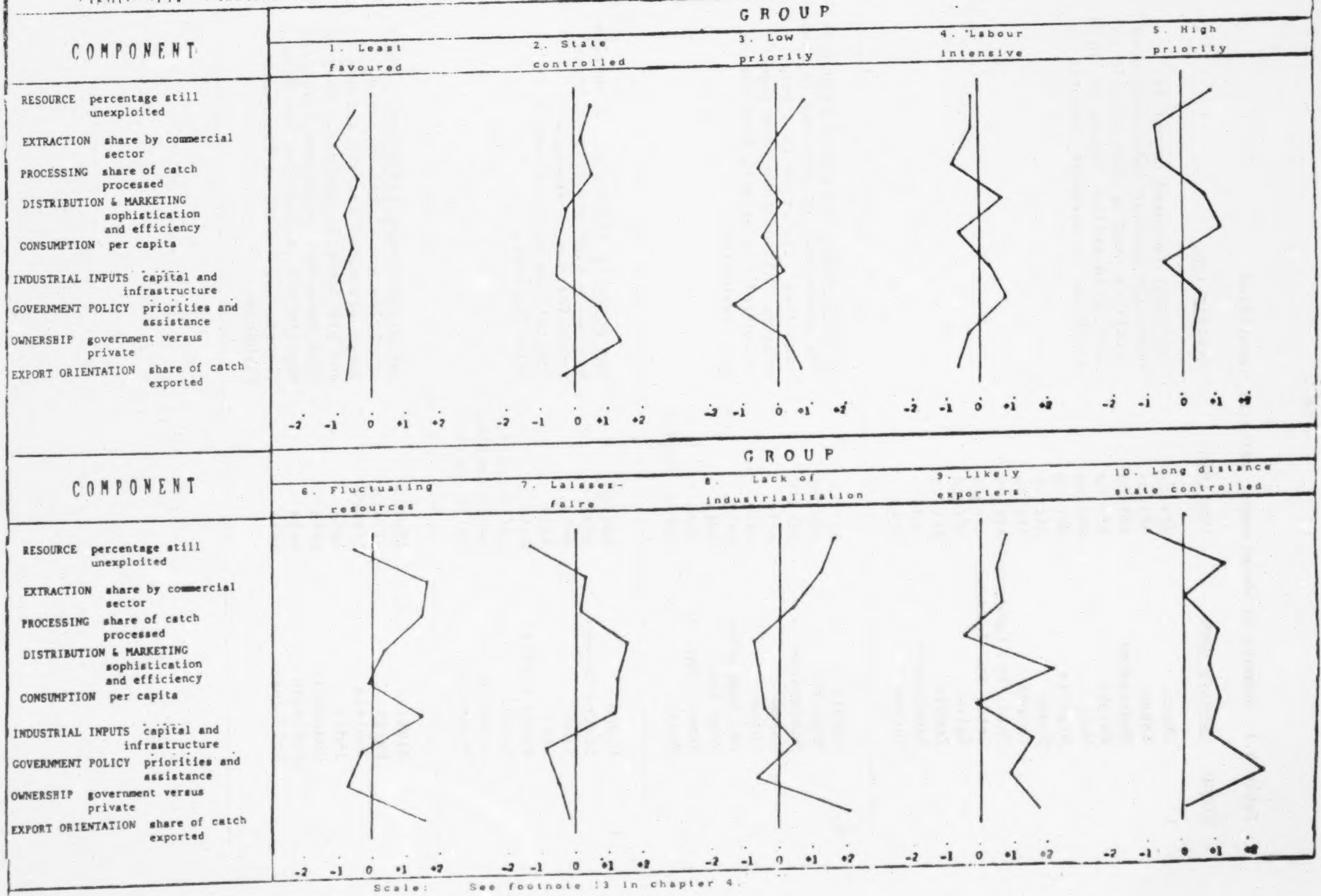
13/ Each group's component score in this figure is the arithmetic mean of the countries within it. Each component was scaled so that across the 64-country sample each has a variance of one and a mean of zero. Similarly, deviations from the mean greater than +1 or less than -1, are more than one standard deviation away from the average of the 64 countries, that is, they are exceptional.

Figure 4.1. Patterns of development of groups across FIS components



Scale: See footnote 13 in chapter 4.

Table 4.1 Summary of development patterns identified

Group	Country name	Continent	Description
1	Ghana	Africa	The least favoured countries. Generally poor or under-developed countries needing fish protein but lacking in skills, inputs or infrastructure to maximize resource use.
	Kenya	Africa	
	Madagascar	Africa	
	Malawi	Africa	
	Mali	Africa	
	Nigeria	Africa	
	Sudan	Africa	
	Uganda	Africa	
	Untd. Rp. Cameroon	Africa	
	Untd. Rp. Tanzania	Africa	
	Zaire	Africa	
	Zambia	Africa	
	Bangladesh	Asia	
	Turkey	Asia	
2.	Angola	Africa	Largely state controlled fisheries The government is involved in these countries' fisheries to a large degree. All of them have good potential for growth, both marine and freshwater.
	Morocco	Africa	
	Mozambique	Africa	
	Burma	Asia	
	China	Asia	
	Dm. Kampuchea	Asia	
	Viet Nam	Asia	
	Yemen, Dem. Rp.	Asia	
	Mexico	Latin America	
3.	Gabon	Africa	Low priority fisheries. Fisheries are not a high priority in these countries due to resource limitations national wealth or other factors.
	Sierra Leone	Africa	
	Iran	Asia	
	Iraq	Asia	
	Saudi Arabia	Asia	
	Brazil	Latin America	
	Colombia	Latin America	
	Venezuela	Latin America	
4.	Algeria	Africa	Labour-intensive fisheries. These countries are linked by having large artisanal fishery sectors and big domestic markets. Most of them have well organized fisheries departments and all but two have flourishing inland or freshwater fisheries.
	Egypt	Africa	
	Tunisia	Africa	
	India	Asia	
	Indonesia	Asia	
	Pakistan	Asia	
	Sri Lanka	Asia	

Table 4.1. (continued)

Group	Country Name	Continent	Description
5.	Congo Oman Untd.Arab Emirates Guyana Fiji Kiribati	Africa Asia Asia Latin America Oceania Oceania	Small states with growth potential. These small population countries all have relatively good fishery potential, particularly for export. Their governments have made fisheries a high priority sector.
6.	Namibia Argentina Chile Ecuador Panama (Ex. CZ) Peru Uruguay	Africa Latin America Latin America Latin America Latin America Latin America Latin America	Large but fluctuating resources and limited local demand for fish. These countries have large fish meal industries or export oriented processing plants. Although their marine resources are substantial, they suffer from big natural fluctuations.
7.	Côte d'Ivoire Area of Hong Kong Korea, Republic Malaysia Philippines Thailand	Africa Asia Asia Asia Asia Asia	Laissez-faire fisheries. Commercial and private interests predominate in this group of countries which also have good domestic markets and labour intensive fisheries. They all have high per capita consumption of fish.
8.	Mauritania Somalia	Africa Africa	Lack of industrialization. Good fishery potential but with serious lack of skills and inputs and very limited local market.
9.	Senegal Maldives Solomon Islands	Africa Asia Oceania	Likely exporters. Similar to group 5 above these 3 states are well poised to develop the export potential of their fisheries. They all have good traditional fishery skills.
10.	Korea, Dem. P. Rp. Cuba	Asia Latin America	Long distance, state controlled. Strong government control but with somewhat better developed fisheries particularly in deep sea operations

underdeveloped. All but two of the countries are in Africa and the group reflects the needs of that continent in terms of skilled manpower, organization, capital inputs and infrastructure.

The countries with the largest marine resources, Bangladesh and Nigeria, also have the largest populations to feed, 90 and 83 million respectively. Aquaculture potential is high in all of the group except one state, Mali, which has its prospects severely dimmed by the drought in the Sahel. All countries in this group require considerable inputs of capital and technical assistance if their fisheries are to develop to near their potential. Only two of the states, Turkey and Nigeria, are economically strong enough to afford the needed investment themselves. In neither of these countries are fisheries high priority.

The most likely constraints affecting this group include the lack of fuel (98 per cent)[14], aquaculture inputs (71 per cent) and inadequate distribution (72 per cent). Lack of demand (10 per cent) and fluctuating resource (3 per cent) are very unlikely to be observed in this group. In general the processing component possesses the greatest enhancement potential. There is plenty of room for increasing the share of the commercial catch processed and aquaculture shows a strong potential for this group.

Group 2: Largely state controlled fisheries

The second largest group of 9 countries, links countries where the State controls fisheries activity and is involved in their ownership or management to a large degree. Other factors connecting this group are large freshwater fisheries potential (7 states), industrial and export fishing (5 states), deep sea potential (7 states), use of joint ventures (5 states) and generally low level of technology (8 states). The group is also marked by large potential domestic markets with low current per capita consumption because of limited supplies or inadequate distribution.

Reduction fisheries for the production of meal and oil, are prominent in Angola, Democratic Yemen, Mexico and Morocco. Mexico, Morocco and Angola also produce canned fish for local and export markets. Mexico and Morocco are probably the most industrialized of the 9 fisheries, and they also have a greater degree of private involvement in the industry. Shrimp fisheries are important in Mozambique, Mexico and China, and there is some shrimp potential in Viet Nam, Burma, Angola and others. China has the largest freshwater fishery in the world, those of the other eight are relatively underdeveloped but all have considerable potential. The group is the largest fish producer of the ten groups, with over 9.6 million metric tons a year. Together, the countries concerned have a potential production of about twice that amount.

The industrial input constraints are the most predominant, with lack of skilled manpower being the most probable constraint to occur, followed by lack of infrastructure for extraction and repair facilities (60 per cent). The resource component is the least likely to be a constraining feature (1 per cent). A demand constraint is not likely to be observed in this group (3 per cent).

14/ Probability of occurrence of constraints and enhancements. See tables 1 and 2 of Appendix 1 to this chapter.

The study points in this group pertain to good availability of resources and the high priority the government gives to this sector.

Group 3: Low priority fisheries

This group consists of 8 countries which, although they have some fishery potential, have not given high priority to development of their fishing industries. The countries are relatively wealthy, at least five of them being oil producers. It is interesting that they find themselves grouped together as the possession of petroleum or mineral resources was not one of the variables. Only one of the countries, Brazil, is a major fish producer (946,000 tons). Venezuela produced 265,000 tons in 1984. The others land less than 100,000 tons. Most of the group 3 states have the natural resources, industry, infrastructure and capital to develop their fisheries much more but few of them have shown serious interest. They also have a large industrial base which could facilitate fishery system development. Venezuela, one of the few to have embarked on a national programme for fisheries development, has adopted strategies and plans of action which may show the way for the others. Fish consumption is low in all 8 countries with the exception of Sierra Leone (19.1 kg per capita) and Venezuela (13.0 kg per capita). Venezuela plans to increase domestic consumption through efforts in processing, marketing and distribution, and to raise production by improvements in offshore fishing and aquaculture. As in most countries where fisheries have been low priority, there needs to be an improvement to and re-organization of the bureaucracies and institutions dealing with fisheries and more relevant legislation governing their development.

No constraints are particularly outstanding for this group although skilled manpower (51 per cent) and distribution infrastructure are constraining features (47 per cent). Neither availability of parts (2 per cent) nor quality control in extraction will be a problem for this group. The availability of resource and the potential for aquaculture are the two most likely factors to enhance the development of this group.

Group 4: Labour-intensive fisheries

Group 4 identifies seven countries with large artisanal sectors and big internal markets for fish. Over a billion people are represented in the group and by far the bulk of the near 6 million ton catch is taken by small scale artisanal fishermen. Their fisheries then provide not only much needed protein, but also vital employment for millions of persons in rural or coastal communities. Although the countries are mainly poor, having large populations to support, several of them are petroleum producers and all have a fair degree of industrialization and infrastructure. India, Indonesia, Pakistan and Tunisia are net exporters of fish products. Egypt and Algeria are net importers. Together, the 7 countries have considerable marine and freshwater potential, possibly nearly twice their present production. Egypt is least favoured with fishing grounds. Tunisia, Algeria and Sri Lanka have modest resources. All of the countries have fairly well developed fisheries administrations and have plans to continue development of the sector.

Development programmes will concentrate on increasing production for domestic consumption, with exportable species like shrimp and tuna being traded for foreign currency. Some canned sardines are also exported. In order to maintain high employment levels, technologies introduced to the artisanal sector will be appropriate or intermediate. Local legislative and administrative measures should be taken to prevent or reduce conflicts between artisanal and industrial sectors. Indonesia banned trawling for shrimp or fish in all except eastern waters to reserve these fisheries for the artisanal fleets.

In most of the group 4 countries, governments have attempted to establish and direct fisheries co-operatives for the small scale producers. These mostly serve the domestic market. Canneries and freezing plants are either privately owned or government financed domestic enterprises.

For this group there is no single constraint that is overwhelmingly likely to occur. Nonetheless inadequate infrastructure would be the most probable (39 per cent). The demand does not pose a constraint to this group.

This group has many positive factors which are likely to be observed. These focus on the government policy and the processing components of the system. An example of the former is the high priority accorded to the sector by the government (99 per cent) and of the latter the abundance of fresh fish caught which remains unprocessed (89 per cent).

Group 5: Small states with growth potential

Group 5 groups six states which appear to be linked mainly because of their growth potential, especially in export fisheries. All are relatively small countries, the largest - the Congo with 1,569,000 people - being the only one with over a million in population. Domestic consumption is therefore limited. But interestingly, all six have exportable fish resources. Fiji and Kiribati have stocks of migratory tuna. Guyana has shrimp. Off Oman and the United Arab Emirates lies a large unexploited stock of mesopelagic fish which could be processed into meal for export. The Congo does not enjoy particularly good fishery resources but is still capable of producing dried fish for export to neighbouring countries in west and central Africa.

Artisanal fisheries are prominent in each of the states, most of whom have good traditional fisheries skills. At present the total production for all six countries is less than 0.3 million tons, Oman and the United Arab Emirates being the biggest producers. Guyana is one of the few shrimp fishing countries to attempt to utilize the by-catch which is normally dumped at sea. It also plans a large increase in production, chiefly from the artisanal sector. The increase has a three-fold aim: to increase employment, to boost exports, and to improve nutrition and national food security.

In all of group 5, per capita consumption of fish is high. Nevertheless there is room for an increase in the local market provided that quality, handling and distribution are improved. This is true for all except the island States of Fiji and Kiribati. Technical assistance is required by all the countries if they are to develop their fisheries, as they lack either the investment capital or the skills and technologies in both the harvesting and processing sectors. This group has a low degree of industrialization and infrastructure, as well as a low industrial base. Together the six should be able to produce over a million tons of fish more per year and to market most of this catch abroad.

Lack of skilled manpower (64 per cent), lack of locally available fuel (76 per cent) and lack of distribution infrastructure (60 per cent) are the outstanding constraints to this group. This group's enhancements relate to resources, processing and government policy. These countries are highly likely to have adequate resources for expansion (90 per cent), and even the share of present catch which is processed is low, indicating further room for development (91 per cent). Finally, it is extremely likely to find strong government support in the countries of this group (100 per cent).

Group 6: Large but fluctuating resources and limited local demand for fish

Group 6 has seven states with large industrial or processing heavy industries. Together they produce over 9 million tons of fish a year, but over 60 per cent of this, 5.6 million tons is used for reduction to oil and meal for animal feed. The countries in the group also share a common problem in that their marine resources tend to fluctuate for natural reasons. Thus Peru, which once landed over 12.0 million tons in a year, now produces only 3.0 million tons. The least affected states in this respect are Argentina and Uruguay. The group is strong in exports, their net export trade exceeding US$ 1.1 billion. Namibia does not produce fish meal or exports at present but has the potential to do so in the future.

Being composed predominantly of South American countries, the group reflects the conditions and problems facing the fisheries of Latin America. There was a massive over-investment in the fish meal industry during the build-up of the anchovy fishery in the 1960s and early 1970s. There has also been some over-capitalization of the fish canning industry. Domestic markets were neglected owing to the availability of relatively cheap beef. A considerable re-structuring of the industry is overdue now following the collapse of the anchovy industry. Most of the countries in the region now wish to develop their domestic markets as well as the export trade, to diversify and get away from single species dependency, and to reduce the degree of imported vessels and machinery in their fisheries. Peru's strategy[15] illustrates the new approach to fisheries in Latin America. Much more attention is to be paid to local consumers and to the production of more cured fish and cheaper canned fish for this market. Export products will involve more high value commodities: frozen, canned and preserved as well as the lower value fish meal. New technologies are to be introduced and vessels and plants modified to harvest and process alternative species. Distant water fishing grounds may be exploited initially by foreign vessels under joint venture or licencing arrangements.

This group stands out as having across the board low constraints with the extraction sector standing out in this regard. The main danger for this group is its fluctuating resource (52 per cent). This group is also blessed with a number of positive factors. In the industrial inputs component, good availability of intermediate and capital goods is likely to occur (78 per cent). In the government policy component these tend to accord a high priority to fisheries (85 per cent) and have a positive attitude towards foreign investment (69 per cent). This latter point is substantiated by the high likelihood of successful joint ventures being found in this group (78 per cent). Finally, for countries in this group, the likelihood of their local markets being completely untapped is high (100 per cent).

15/ As presented in the case study on Peru summarized in chapter 5.

Group 7: Laissez-faire fisheries

Group 7 has six fishing states which are characterized by private enterprise in the industry, and high per capita consumption of fish in the local population. Two of the countries are net fish importers - Malaysia, US$ 8.7 million, and area of Hong Kong, US$ 203 million. But together the other four states have a net fish export trade of over US$ 1.4 billion. Thus the commercial side of the industry is clearly prominent in this group. Although the group has very large fishery resources, these are being harvested close to their maximum sustainable yield. Future expansion will therefore be limited and probably come from either distant water grounds or aquaculture production. Some countries have already suffered from over-capitalization in certain sectors, such as the Philippines in tuna fishing, and Thailand in the domestic trawl industry. Thus any increase in their total production of 7.6 million tons will be marginal. There is scope, however, for adding value through better processing and for increasing marketed fish through reductions in spoilage.

Most countries of group 7 are emerging industrial powers and have the technical expertise and infrastructure to support technological improvements in harvesting and processing. Ship and boat building are quite developed in the group, especially in the Republic of Korea, and the standards of their processing industries are already well recognized by fish importing countries.

Fish culture is strong in the Philippines and likely to develop in Malaysia and Thailand. Culture activities previously concentrated on milkfish but higher value shrimp are gradually replacing these in the brackish water coastal ponds. Seawater culture of mussels, oysters and clams is also increasing.

This group is characterized by across the board low level of likely constraints with the exception of a resource constraint (86 per cent). The major strengths of this group include a high tendency to encourage foreign investment (74 per cent) and the room for expansion in the amount of catch processed (67 per cent).

Group 8: Lacking industrialization

Group 8 links two largely desert countries in Africa, one facing the Atlantic and one the Indian Ocean. Both states have substantial marine fish resources but both lack the industry to exploit them. Mauritania in north west Africa is more developed and has been pursuing an aggressive fisheries development policy. It has large stocks of sardine, mackerel, squid, shrimp and demersal fish. Until recently, most harvesting was done by foreign vessels fishing under license or as part of joint ventures. The government is now building up the national fleet and gradually reducing the foreign vessel role. There have been major investments in processing facilities which at present suffer from a temporary over-capitalization. All fish caught must be landed at Nouadhibou which is developing rapidly as a major African fishing port. Mauritania currently earns about US$ 148 million from exports of around 285,000 tons of fish.

Somalia, on the horn of Africa's east coast, also has a large fishery resource, mainly small pelagics and demersal fish. There may be significant stocks of mesopelagic species in the deep water offshore, but reliable information on that resource is not available. Unlike Mauritania, Somalia has no fishing fleet or processing facility to speak of. The coast is devoid of natural harbours and the local population quite poor and unskilled. It will therefore take considerable investments of capital and technical assistance to enable Somalia to benefit from the fishery. Nevertheless, the export potential is large, both in terms of fish meal, and fish for human consumption. There might aso be possibilities for the production of dried fish or fish protein for feeding needy populations in the drought stricken area to the north. This small group, then, is similar to group 1, but with special development problems.

As the name of this group implies, the industrial inputs component contains the most probably constraints. These include lack of intermediate and capital goods (68 per cent), general lack of extraction and processing infrastructure (62 per cent), insufficient repair and maintenance facilities (64 per cent), and lack of skilled manpower. In addition, domestic demand is lacking (100 per cent) and the resource in this group tends to fluctuate (68 per cent).

In spite of this fluctuating resource, this group could safely expand its utilization (93 per cent). The governments seem to be aware of this potential and as a result there is a high tendency to give a high priority to the sector (100 per cent). The results seem to be encouraging, since the probability of successful joint ventures is high for this group (88 per cent). Finally, if the measures could be taken to overcome weak domestic demand, then the degree of untapped local markets could be a positive factor to this group (100 per cent).

Group 9: Likely exporters

Group 9 is made up of the Solomon Islands, Maldives and Senegal. They relate closely to the countries in group 5, but with some important differences. They have somewhat better developed fishing fleets, a slightly higher involvement of joint ventures, and enjoy very high priority attention from their governments.

All are potentially large exporters, Senegal leading the way with US$ 134 million in fishery exports. Tuna and pelagic fishes are the main resource species though there is also potential for mariculture of oysters and clams. Senegal, with about 6 million in population, has by far the largest domestic market of the three. It plans to expand this through better communication to improve distribution and by granting credit to small traders to purchase fish trucks and insulated boxes. Employment is to be boosted through expansion of the artisanal fisheries, and by limiting exploitation of certain stocks to Senegalese fishermen. Joint ventures and licenses will continue to be arranged with foreign partners for harvesting offshore and deep sea stocks but local boat building and ship repair facilities will be strengthened. Export processing industries (particularly canning) will be assisted and encouraged. Some assistance may take the form of an energy subsidy.

The main problem for this group is its lack of locally available fuel (74 per cent); to a lesser extent, the lack of skilled manpower may pose a constraint (60 per cent). Pre-eminent among the likely enhancements for this group is the positive government attitude. This attitude is manifested in the high priority accorded to the sector (100 per cent) and high tangible assistance (84 per cent). As a result, a joint venture in this group has a high probability of success (86 per cent). Two reasons for this government interest are the availability of unutilized resources (84 per cent) and a high share of an already favourable local market still untapped (100 per cent).

Group 10: Long distance, state controlled

Group 10, the last one, contains two socialist states with well developed fishing industries. Both have good domestic markets with high per capita fish consumption. The Democratic People's Republic of Korea is by far the largest, with a production of 1.49 million tons, about half of which is used for the fish meal reduction industry. Cuba lands currently over 182,000 tons of fish, about 15 per cent of which is used for reduction.

Group 10 then resembles group 2 in ownership and government control, high priority and importance of the domestic market. It differs in having a generally better developed processing or post-harvest sector, and much higher per capita fish consumption. Both the Democratic People's Republic of Korea and Cuba have a large high seas fishery (outside of the EEZ). None of group 2 has this dimension, and with the exception of Mexico and Mozambique, their offshore EEZ fisheries are at a low stage of development. Group 10 has good seafaring and fish harvesting skills. Cuba has some joint venture arrangements with CMEA countries but the Democratic People's Republic of Korea largely manages to pursue its fishery with its own resources. Future potential is limited for Cuba save in open sea fisheries, but the Democratic People's Republic of Korea has a large unexploited potential.

This group does not present any serious constraints. The one exception is related to possible resource limitations (48 per cent). A positive feature to be taken into account is the high government priority accorded to the sector, coupled with tangible asistance (100 and 72 per cent respectively).

APPENDIX 1

to chapter 4

Probablities of FIS constraints and enhancements to occur in various country groupings.

ble 7. Probabilities of FIS constraints to occur in the various country groupings (in percentage)

ountry groups onstraint umber a/b/	1 least favoured	2 state con- trolled	3 low priority	4 labour inten- sive	5 high priority	6 fluctuat- ing re- sources	7 laissez faire	8 lack of industri- alization	9 likely expor- ters	10 long distance state con- trolled
esources										
	23.4	1.2	10.8	3.4	0	32.8	86.4	0.1	0	48.0
	10.5	1.4	16.7	5.7	21.0	6.1	14.0	10.5	9.0	2.3
7	3.0	7.4	3.2	3.3	0.1	52.2	0.6	67.9	2.1	0.2
xtraction										
	18.7	8.2	23.7	4.4	9.6	0	2.6	0.2	1.0	1.1
	2.7	9.7	0	1.6	14.0	0	1.9	0.2	12.2	16.3
rocessing										
	29.3	14.3	20.7	14.9	22.0	4.6	6.9	21.8	11.1	17.5
istribution										
	71.8	39.1	46.9	39.4	59.3	19.0	20.8	9.4	23.0	37.3
	8.0	7.4	13.3	12.3	8.0	4.3	7.8	1.1	3.2	14.4
onsumption										
	0	2.6	5.2	0	1.7	18.0	0	99.8	3.5	0
ndustrial input										
0	46.7	20.7	8.6	1.5	22.0	2.6	0	67.9	11.5	0.2
1	44.2	43.0	1.6	14.0	10.9	1.2	0.4	20.9	13.8	10.2
2	71.1	22.1	16.0	17.5	9.7	5.7	11.2	9.6	2.9	5.1
3	51.4	52.3	33.7	23.1	57.0	0.2	2.0	61.5	23.7	3.1
4	28.4	50.0	7.5	27.8	30.0	8.4	2.0	64.0	34.8	4.9
6	24.5	26.0	7.6	10.8	25.5	11.9	15.3	12.4	35.7	21.3
9	10.3	6.3	33.5	14.1	13.1	0.3	3.0	3.1	1.1	4.2
4	54.6	60.1	51.4	21.4	63.9	9.9	11.7	79.7	59.9	10.6
6	98.4	9.3	6.6	1.4	76.0	10.3	2.7	38.0	73.6	0.5
overnment policy										
1	6.7	6.4	15.1	10.6	0	1.3	0.1	3.4	0	0
thers										
5	2.0	15.6	3.8	1.3	0	0	0	0.1	0	5.3

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a/ See table 3.3 for a more detailed description of each constraint.

Table 2. Probabilities of FIS enhancements to occur in the various country groups (in percentage)

Country groups										
Enhancement a/	1 least favoured	2 state controlled	3 low priority	4 labour intensive	5 high priority	6 fluctuating resources	7 laissez faire	8 lack of industrialization	9 likely exporters	10 long distance state controlled
Resources										
1	20.3	73.0	61.3	44.7	89.9	24.8	1.2	93.0	84.3	5.6
2	1.3	7.6	1.2	4.9	23.6	21.2	3.2	0.6	49.9	6.0
Extraction										
4	7.8	21.7	2.5	28.1	20.0	41.0	16.0	10.2	51.8	32.6
5	0	0	0	0	0	2.5	1.2	0	0.2	0
Processing										
3	46.1	3.0	13.4	89.4	90.7	0	66.9	0	11.5	94.6
6	81.6	31.2	44.5	72.2	42.3	0.7	13.4	1.4	1.7	12.4
14	70.3	53.9	55.4	52.7	28.0	46.1	46.7	20.1	12.5	34.5
Industrial input										
7	1.7	3.5	7.4	15.4	2.1	77.7	55.4	6.8	5.5	41.3
8	0.6	2.6	8.4	13.5	0.4	34.4	3.3	3.0	0.2	7.5
15	0.7	0	46.0	3.5	12.1	0	3.3	0	0	0
Government policy										
9	12.3	95.7	0.2	99.0	99.8	85.2	5.1	99.6	100.0	99.0
10	0.5	43.4	0	62.3	17.5	2.8	0.6	0.4	84.1	71.8
11	26.9	16.4	42.0	65.0	34.3	68.7	74.3	22.7	26.1	25.4
Ownership										
12	14.9	55.7	16.1	50.5	54.1	77.5	16.7	88.2	85.9	45.5
Consumption										
13	0	0	0	0	0	100.0	0	100.0	99.8	0

a/ See table 3.4 for a more detailed description of each enhancement.

5. THE COUNTRY CASE STUDIES

To place the group-specific results of chapter 4 and later chapters in a country-specific context, 10 country case studies were performed, one for each derived archetypal development pattern. It is the purpose of the present chapter to present[16] brief abstracts of these case studies. Subject to the considerations mentioned below, each case study country was selected using a technique that identifies which country in a group is the most typical.

Though each case study country has been selected to be indicative of its development pattern, it is not the pattern's perfect archetype. Thus, the 10 case study countries should each only be considered representative of their group.

In the present case, institutional considerations required that a minimum of 4 African and 3 Latin American countries be selected. Later, these were expanded to include some Asian countries. Thus, country selection was to be made conditional on such quotas. This consideration is reflected in the countries selected: Group 1 - Zambia; Group 2 - Angola and Mexico; Group 3 - Venezuela; Group 4 - Indonesia; Group 5 - Guyana; Group 6 - Peru; Group 7 - Philippines; Group 8 - Somalia; Group 9 - Senegal.

The ten country case studies included in this study were developed based on the MEPS approach alluded to above and described elsewhere.[17] Their purpose was to provide concrete examples in support of relationships and conclusions which surface from the cross-sectional analyses of the 64-country, 63-variable data set.

Based on the MEPS conceptual framework, each country case study is presented in chapter 5 comprising two parts. First, a base diagram, an example of which may be found in chapter 3, is presented. Second, each diagram is accompanied by a component-by-component descriptive summary of the country's FIS. Since each of the ten studies are described in terms of the same nine MEPs components, structural comparisons are facilitated - a central goal when considering patterns of development.

The country case studies were useful in providing an in-depth knowledge of the characteristics of the group, illustrating more closely the development patterns and contributing to the assessment of constraints and enhancements characteristic of each group. The group-specific strategies and actions necessary to eliminate problems that hinder their successful application were also analyzed in the light of the experiences found through the country case studies.

16/ Very brief abstracts of the case studies are presented below. The full texts will issued separately.

17/ For a complete description of MEPS, together with an example of its application, see UNIDO/IS.569 "A Programme for the Integrated Development of the Peruvian Oils and Fats Production/Consumption System", Sectoral Studies Series No. 19.

Table 5.1. General fisheries data for the country case studies

Type of data	Indicators	Guyana	Mexico	Peru	Venezuela	Angola	Senegal	Somalia	Zambia	Indonesia	Philippines	Cuba
	Countries:	Guyana 1985	Mexico 1984	Peru 1984	Venezuela 1984	Angola 1985	Senegal 1983	Somalia 1984	Zambia 1983	Indonesia 1984	Philippines 1984	Cuba 1984
	Groups:	5	2	6	3	2	9	8	1	4	7	10
	Population (thousands):	936	77,040	19,197	17,189	8,540	6,352	5,423	6,242	157,495	54,996	9,723
I. Areas	1. EEZ area (thousand Km^2)									2,700	1,400	
	2. Inland waters(thousand Km^2)	1812	4951	522	3000	n/a	419	1032	40	13,700	8,000	-
	3. Length of coastline (Km)	430	9219	2330	2900	1650	550	2950	-	30,000	17,640	6,100
	4. Shelf area (to 200 metres) (thousand Km^2)	48.60	388	82.80	90.6	51.0	23.8	32.5	-	775	184	70
	5. Islands									13,000	7,000	
II. Resources (MSY)	1. Marine (thousand mt)	135	3673	5100	243.9	700	474	180	-	4,200	2,050	210
	2. Fresh water and culture (000's MT)	6.2	1000	n/a	n/a	50	n/a	-	80	1,400	950	18
III. Catches	1. Marine total	43.5	990.5	2951.6	244	42.2	251.7a/	19.6	-	1,713	1,502	184.3
	2. Marine resource utilization (%)	32	27	58	-	60	53	11	-	35	60	85
	3. Fresh water and culture (thousand mt)	0.8	144	29.6	21	-	-	-	67	540.2	658	13.6
	4. Fresh and culture resource utilization (%)	13	14	-	-	-	-	-	85	37	60	65
	5. Total industrial (thousands mt/%)	6.3/15	573.5/50	2847.6/95	110/42	63.2/100	108/60	11.9/61	4.7/7	112.7/5	518.4/24	180.1/91
	6. Total artisanal (thousand mt/%)	36.5/85	561/50	133.6/4.5	155/58	-	70.7/40	7.7/39	61.7/9	1,870/83	1,339.2/62	13.8/7
	7. Aquaculture								0.6/1	270.4/12	302.4/14	4/2
IV. Processing	1. Share of industrially processed fish in total catch (%)	8	70	93	54	22	37	67	70	80	75	57
	2. Share of artisanally processed fish in total catch (%)	0.2k/	0.6	1	6k/	60	23	27	75	40	30	10

Table 5.1. (continued)

Type of data	Indicators Countries:	Guyana	Mexico	Peru	Venezuela	Angola	Senegal	Somalia	Zambia	Indonesia	Philippines	Cuba
		1985	1984	1984	1984	1985	1983	1984	1983	1984	1984	1984
	Groups:	5	2	6	3	2	9	8	1	4	7	10
	Population (thousands):	936	77,040	19,197	17,189	8,540	6,352	5,423	6,242	157,495	54,996	9,723
V. Employment	0. Total fisheries (thousand)	10,000	83.1	55.0	40.0	n/a	n/a	n/a	50	3,000	1,300	39.2
	1. Share in total employment (%)	-	0.4	0.9	0.9	-	-	-	-	5%	-	-
	2. Extraction (thousand)	5.0	54.8	36.4	30.0	77.7g/	36h/	6.4i/	30	1,400	770	12.5
	3. Processing (thousand)	0.5	28.2	18.6	10.0	2956	n/a	n/a	20	500	320	25.8
	4. Post-harvest culture(thousand)								0.5	990	210	1
VI. Consumption	1. Per capita consumption (Kg/yr)	41.6	8.7	12.9	10.1	19.6	24.5	0.5f/	12.8	13.5	33.0	17.2
	2. Share of fresh fish in total consumption (%)	94	40	80	65	18	40	42	25	50	65	40
	3. Contribution to animal protein supply (%)	40	30	-	-	80	30-80	0.3	24	60	30	16
VII. GDP	1. % Contribution to GDP	2.5	0.5	1.24	3	-	3.1	0.8	1.0	1.7	5.0	-
VIII. Exports - imports	1. Exports net (thousand mt)	2.3	73.6	562.2	39.4	3.86	93.99	7.6	7	65.4	51.9	35
	2. Exports (million US$)	20e/	453	253.1	36	5.0	52.3b/	7.0	0.05	229.2	116.8	157.9
	3. Export share in total production (%)	8	7.5	53	24	6	44	87	-	3.3		
	4. Share in total exports (%)	11	1.8	8.2		n/a	25		-	1.2	2.6	2.8
	5. Important export markets	USA, Japan	USA, Japan	USA, France, Italy		EEC, Japan	France, Cote d' Ivoire, Spain	Italy	Congo, Zimbabwe	Japan, Thailand, Singapore	Japan, Singapore, HongKong, USA	USSR
	6. Imports (thousand MT)	-	613	-		(131.5)c/	30.8l/	n/a	3.6	50.4	6.1	135.5
	7. Fish imports (million US$)	-	-	-			-		1.12	28,324	2,700	32,200

Table 5.1. (continued)

Type of data	Indicators	Countries:	Guyana	Mexico	Peru	Venezuela	Angola	Senegal	Somalia	Zambia	Indonesia	Philippines	Cuba
			1985	1984	1984	1984	1985	1983	1984	1983	1984	1984	1984
		Groups:	5	2	6	3	2	9	8	1	4	7	10
		Population (thousands):	936	77,040	19,197	17,189	8,540	6,352	5,423	6,242	157,495	54,996	9,723
IX. Finance	1. Government investment in fisheries (million US$)		5.8	757.1	0.1	11.4	57.2d/	200b/	351.264j/	435.9n/o/	1.4n/	-	-
	2. Allocation as percentage of total budget		1.0	1.1	6.2	-		0.86		26	13	-	-

a/ The catch with foreign fleet was 251.7 in 1983.

b/ Values are in millions of (current) CFA francs.

c/ Angola does not import fish but receives the by-catch from the foreign fleet.

d/ This is what the total national investment will be for the year 1986.

e/ Estimated. Export earnings from shrimps caught by national vessels were US $8.76m. Foreign fishing licences brought in US $184,000 and export levy on shrimp US $877,000.

f/ For 1980, but in the capital Mogadishu the annual per cap. was 1.24 kg in 1983.

g/ 50,000 are part-time, 1982.

h/ Source: FAO Yearbook of Fishery Statistics, 1984.

i/ 2800 full-time plus 3600 occasional fishermen.

j/ Values are in Somali shillings. Of this total, 22,480 was from Somali government sources and 299,876 was from foreign loans, and 78,918 was from foreign grant sources.

k/ Guyana included 1 enterprise for cured fish with a production of about 350 MT net weight.
Venezuela included 4 enterprises for cured fish with a production of about 820 MT net weight.

l/ Landed fish (tuna) by foreign fleet.

m/ Total figure on marine catch includes 63,800 MT of catch by domestic fleet.

n/ Includes expenditure in agriculture.

o/ Covers 1984 - 1986 period.

The main function of the country case studies is to give an in-depth illustration of the characteristics of a particular FIS pattern of development. This is done through the description of the FIS (through its 9 components - year 1983/85), the identification of the main technical and economic constraints affecting the development as well as prospects for industrial development and investment.[18] The exercise also includes the analysis of the policies and strategies being applied to each country and thus contributes to the design and discussion of strategies and suggested action for the different groups or patterns of development.

In this section, a brief description of the countries' FIS is given.

The structure of the FIS is presented through a base diagram where the 9 components and their linkages are pictured. System flows are given (economic and physical), stock variables such as installed capacity are included as well as performance indices such as the level of capacity utilization. The institutional framework of the FIS is also shown in the base diagram. For group patterns and country membership please see chapter 4, table 4.2 and figure 4.2 . Table 5.1 shows quantitative information derived from the country case studies.

5.1 Zambia[19]

Typical of states in group 1, Zambia has limited fishery potential and is lacking in industrial resources, energy, infrastructure and skills. The population is largely low income, with low animal protein intake. Fish is therefore important from health and dietary viewpoints but cannot command high prices if it is to meet the needs of the general populace. The demand for fish is high and has been growing at an annual rate of 8.3 per cent. This high per capita consumption (12.8 kg) is now declining, however, due to shortfalls in supply.

As can be expected in such a situation, the capture and post-harvest FIS components are almost entirely artisanal in nature and the level of technology used is simple. What mechanization exists on fishing vessels consists of outboard engines or small inboard diesels. Boatbuilding skills are adequately developed in several materials including timber, marine plywood and g.r.p. Flat bottom, planked canoes and dugouts are used in swamps and rivers and clinker-built "banana" boats and surf boats are used on the lakes.

Fresh fish is transported on ice in insulated boxes fitted to small trucks. Tilapia is the most popular fresh fish. Other species are mostly hot, smoked or sun-dried. There was formerly a regular export of split salted fish to Zaire. A fresh water sardine from Lake Tanganyika has been successfully introduced to Lake Kariba. These "kopenta" are mostly sun-dried after capture and transported dry to the main markets. One of the constraints to fisheries development in Zambia is the great distances from fish landing places to the population centres. The latter are concentrated in the copperbelt and around Lusaka.

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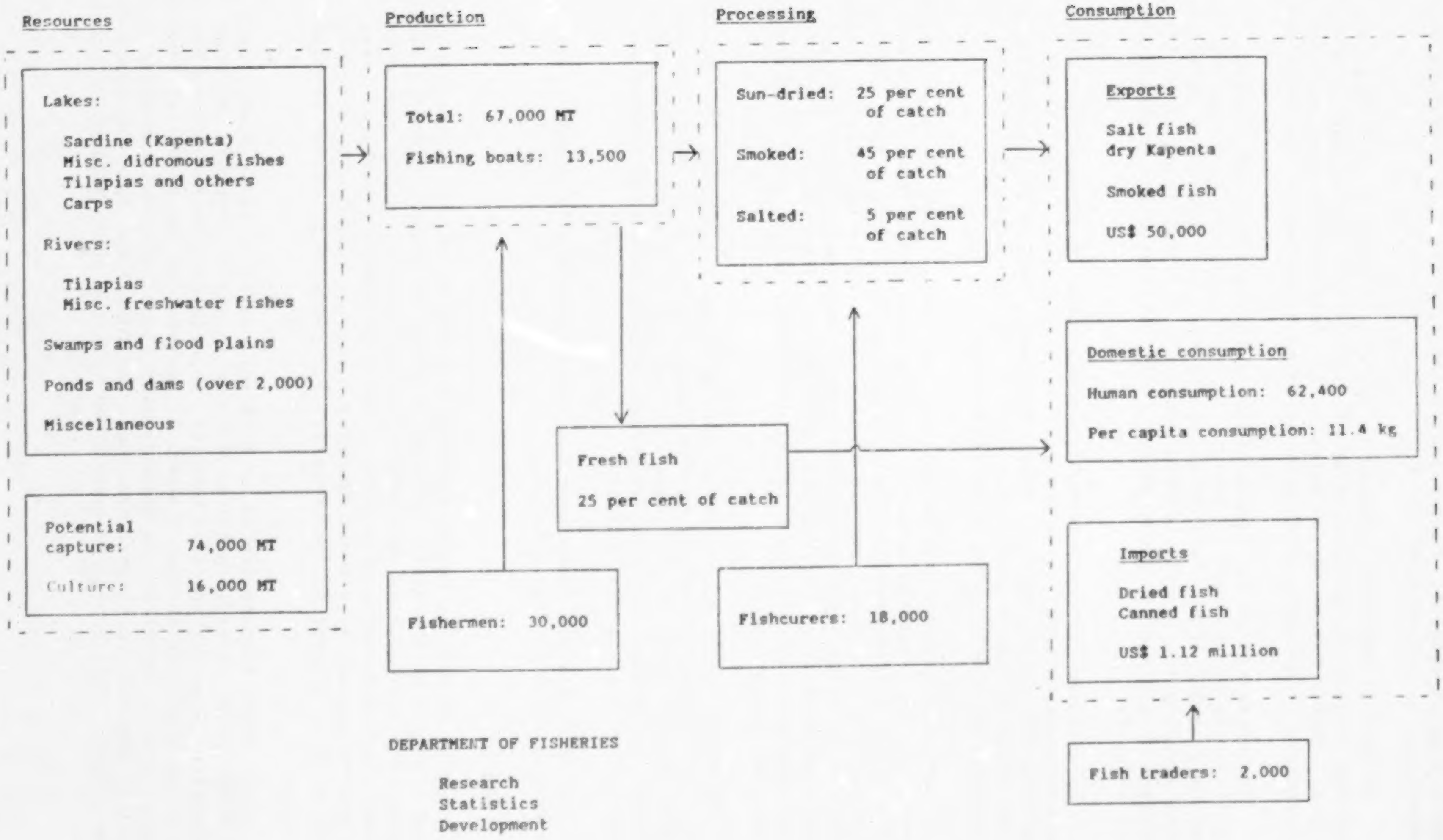
[18] As defined in chapter 3.

[19] These results are based on a mini case study and, hence, are less detailed than those of the other countries in this chapter.

Figure 5.1. Base diagram FIS Zambia 1983


Resources
Production
Processing
Consumption
Lakes:
Sardine (Kapenta)
Misc. didromous fishes
Tilapias and others
Carps
Rivers:
Tilapias
Misc. freshwater fishes
Swamps and flood plains
Ponds and dams (over 2,000)
Miscellaneous
Potential capture: 74,000 MT
Culture: 16,000 MT
Total: 67,000 MT
Fishing boats: 13,500
Fishermen: 30,000
Fresh fish
25 per cent of catch
Sun-dried: 25 per cent of catch
Smoked: 45 per cent of catch
Salted: 5 per cent of catch
Fishcurers: 18,000
Exports
Salt fish
dry Kapenta
Smoked fish
US$ 50,000
Domestic consumption
Human consumption: 62,400
Per capita consumption: 11.4 kg
Imports
Dried fish
Canned fish
US$ 1.12 million
Fish traders: 2,000
DEPARTMENT OF FISHERIES
Research
Statistics
Development

Aquaculture potential has been demonstrated and both small scale and large scale fish farming is feasible, but total culture production is only 100 tons a year at present. Much research and training work continues to concentrate on aquaculture.

In most of the above, Zambia is typical of group 1 countries, and its problems reflect the general array of difficulties facing agriculture in Africa. Zambia has no marine waters. Its fresh waters have declined as a consequence of droughts which have affected countries to the north and east.

The character of the Zambian fishing industry has not changed significantly in the last 10 years. Lack of organization among the fishing community is one of the factors affecting the poor return for their catch and, thus, impeding their socio-economic uplift. Problems in distribution, and a shortage of storage and preservation facilities are other problems affecting this industry.

To maximize fishery potential, Zambia needs to expand fish farming, improve conservation, and reduce post harvest losses. Small scale ice plants, better access roads, improved fish containers, better quality curing and infestation control would prevent much of the spoilage. All of this could be achieved with simple small scale technology.

Zambian fishermen have no sailing experience. The introduction of appropriate sail-rigs on suitable vessels could reduce fuel costs and improve the economic performance of fishing boats on the larger lakes. The initial introduction of outboard engines in the 1960s, while technically successful, proved to be rather expensive, with higher fuel, maintenance and replacement costs than were first anticipated. The small, slower-running, air-cooled diesel engines proved to be a better investment though they required a larger vessel for installation.

There is little scope for increasing capture fisheries save perhaps for deep water lining or netting in the larger lakes. A few areas are not heavily fished because there is no access road and hence no fish landing place nearby. Production increases will come chiefly from fish farming and through reduction of post harvest losses.

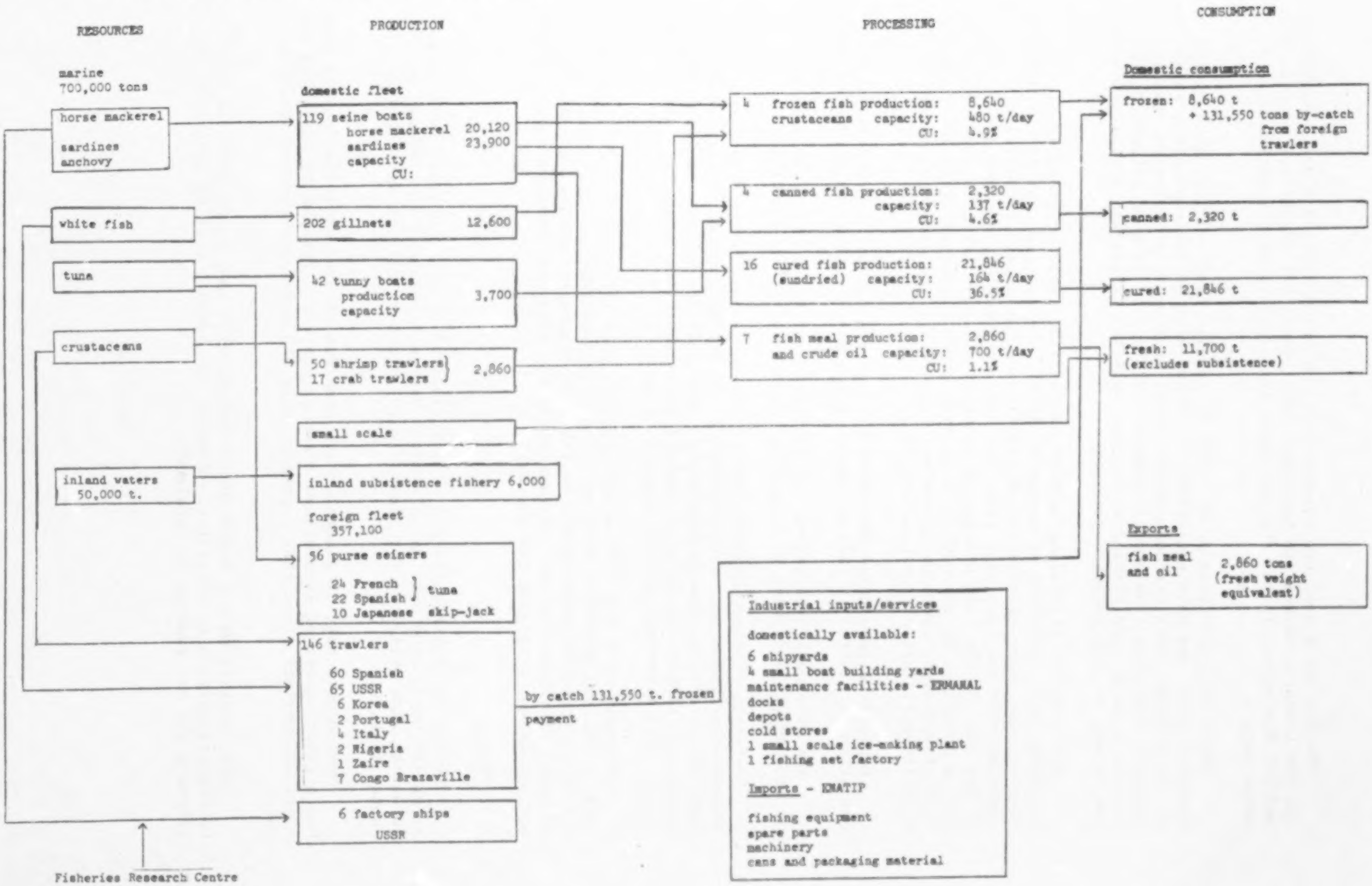
These points are summarized and inter-component linkages illustrated in the base diagram in figure 5.1.

5.2 Angola

Angola as well as Mexico belongs to group 2. Group 2 links countries where the role of the state is large in terms of ownership and/or management. Angola is a typical case in which direct involvement of the government is found in all components of the FIS. There is complete vertical integration of the system through government agencies. For the time being no foreign investment is allowed in the country. The resource potential is high.20/

20/ Major species are horse mackerel, sardine, white fish, tuna, shrimp and crab. There is still a lot to be done in order to obtain the most productive catch for specific species, especially with respect to fin fish; the catch presently stands at about 28 per cent of the potential (including aquaculture). The fleet has been doubled since 1977, and the major growth was in small boats for artisanal fishing. The tuna fleet also increased in the same period. This growth is associated with the establishment of the EEZ in 1976.

Figure 5.2. Base diagram FIS Angola 1985


RESOURCES
PRODUCTION
PROCESSING
CONSUMPTION
marine
700,000 tons
horse mackerel
sardines
anchovy
white fish
tuna
crustaceans
inland waters
50,000 t.
Fisheries Research Centre
domestic fleet
119 seine boats
horse mackerel 20,120
sardines 23,900
capacity
CU:
202 gillnets 12,600
42 tunny boats
production
capacity 3,700
50 shrimp trawlers
17 crab trawlers
2,860
small scale
inland subsistence fishery 6,000
foreign fleet
357,100
56 purse seiners
24 French
22 Spanish
tuna
10 Japanese skip-jack
146 trawlers
60 Spanish
65 USSR
6 Korea
2 Portugal
4 Italy
2 Nigeria
1 Zaire
7 Congo Brazaville
6 factory ships
USSR
by catch 131,550 t. frozen
payment
4 frozen fish production: 8,640
crustaceans capacity: 480 t/day
CU: 4.9%
4 canned fish production: 2,320
capacity: 137 t/day
CU: 4.6%
16 cured fish production: 21,846
(sundried) capacity: 164 t/day
CU: 36.5%
7 fish meal production: 2,860
and crude oil capacity: 700 t/day
CU: 1.1%
Industrial inputs/services
domestically available:
6 shipyards
4 small boat building yards
maintenance facilities - ERMANAL
docks
depots
cold stores
1 small scale ice-making plant
1 fishing net factory
Imports - EMATIP
fishing equipment
spare parts
machinery
cans and packaging material
Domestic consumption
frozen: 8,640 t
+ 131,550 tons by-catch
from foreign
trawlers
canned: 2,320 t
cured: 21,846 t
fresh: 11,700 t
(excludes subsistence)
Exports
fish meal
and oil
2,860 tons
(fresh weight
equivalent)

The FIS has a dual character - it is oriented towards human consumption for the domestic market (96 per cent) and towards the production of fish meal and oil for export (4 per cent). There is a large domestic market with a large supply.

There is a predominance of catch by foreign fleets. The catch by the domestic fleet has been equivalent to 10 per cent of the potential, while that of the foreign fleet has been 50 per cent, landing only one-third, mainly by-catch fish from trawlers, in Angola. There is a lack of infrastructure to control unauthorized fishing by foreign vessels. Artisanal activities exist but do not receive adequate priority.

The level of processing is high, a characteristic of group 2. It accounts for 75 per cent of domestic catch. The major output is cured fish. However, the level of capacity utilization of the plants is very low, especially in the fish meal line, and also in freezing, canning and drying. 55 per cent of the fish processing industry's labour force is employed by the curing industry, 26 per cent by fish meal and oil processing at low capacity. Lack of supplies, spare parts and maintenance are the principal causes of low capacity utilization (see base diagram).

Supportive industrial infrastructure exists but its present level of operation is limited by lack of spare parts, materials and skilled manpower.

The government recognizes the importance of the sector mainly as a source of food supply and tries to cope with the elimination of bottlenecks.

Potential for development lies in the large marine and considerable inland water resources, existing supportive infrastructure, a large domestic market with a large demand-supply gap. A population with strong fish eating habits and already established markets in neighbouring countries (cured fish) exist. All these are characteristics of group 2.

The main constraints to achieving this potential relate to the present lack of skilled manpower, lack of finance, and disfunction of supportive infrastructure. Actions should be taken in manpower training, rehabilitation of means of production and infrastructure and services within a clear planning and management programme for the FIS.

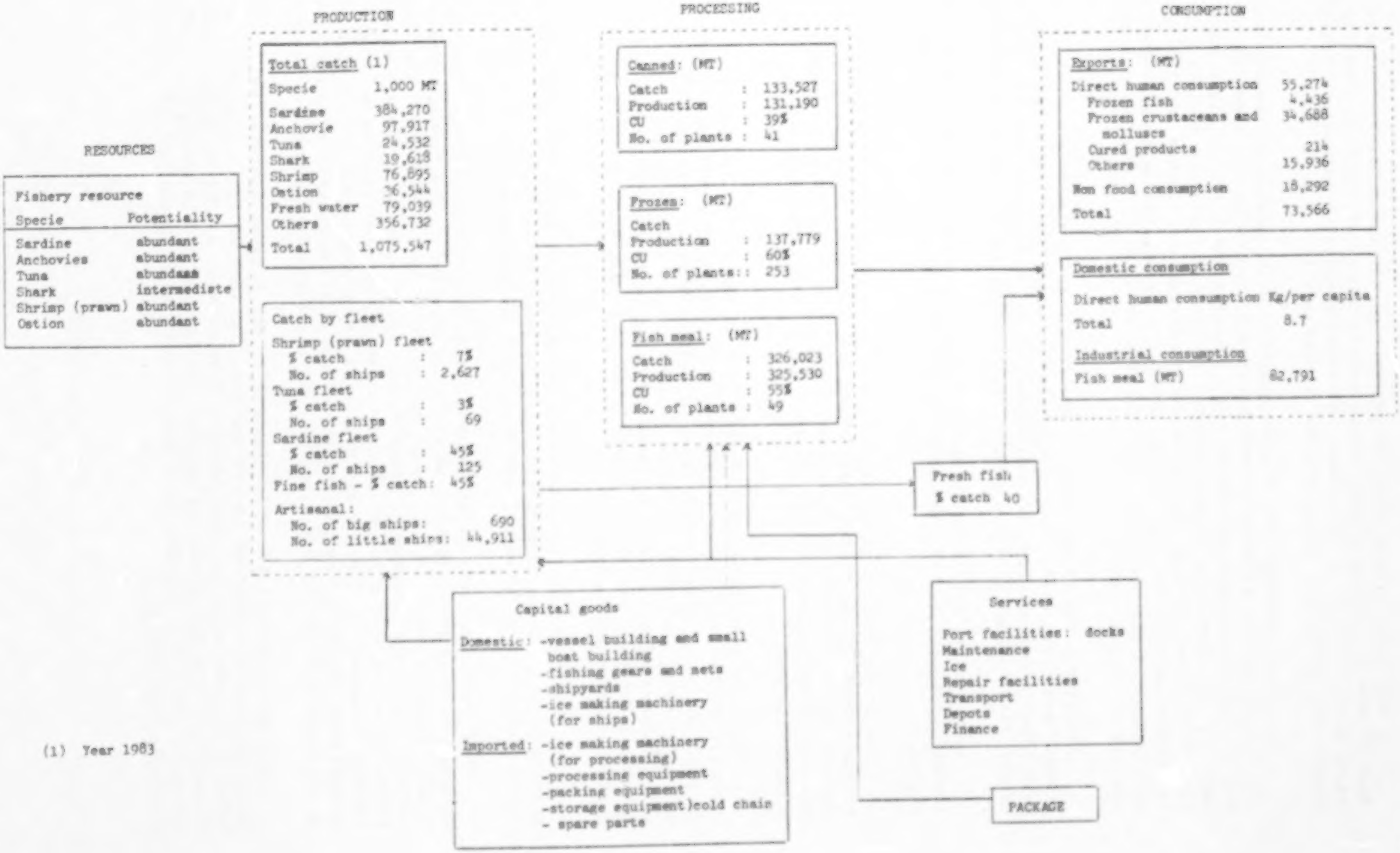
5.3 Mexico

Mexico is probably the most industrialized of the countries from this group (group 2), and also has a greater degree of private involvement in the industry. The public sector plays a very important role in distribution of canned fish.

Mexico does not, in general, have problems of over-exploitation. It also has a great number of aquaculture breeding centres. Freshwater fisheries are still unimportant since they represent only about 7-8 per cent of the total catch.

The fleet is mainly domestically owned, with some joint ventures with foreigners only in tuna fishing. However in general, fishing contracts and licenses are not granted to foreigners.

Figure 5.3. Base diagram FIS Mexico 1984


RESOURCES
Fishery resource
Specie Potentiality
Sardine abundant
Anchovies abundant
Tuna abundaaa
Shark intermediate
Shrimp (prawn) abundant
Ostion abundant
PRODUCTION
Total catch (1)
Specie 1,000 MT
Sardine 384,270
Anchovie 97,917
Tuna 24,532
Shark 19,618
Shrimp 76,895
Ostion 36,544
Fresh water 79,039
Others 356,732
Total 1,075,547
Catch by fleet
Shrimp (prawn) fleet
% catch : 7%
No. of ships : 2,627
Tuna fleet
% catch : 3%
No. of ships : 69
Sardine fleet
% catch : 45%
No. of ships : 125
Fine fish - % catch: 45%
Artisanal:
No. of big ships: 690
No. of little ships: 44,911
PROCESSING
Canned: (MT)
Catch : 133,527
Production : 131,190
CU : 39%
No. of plants : 41
Frozen: (MT)
Catch
Production : 137,779
CU : 60%
No. of plants:: 253
Fish meal: (MT)
Catch : 326,023
Production : 325,530
CU : 55%
No. of plants : 49
CONSUMPTION
Exports: (MT)
Direct human consumption 55,274
Frozen fish 4,436
Frozen crustaceans and molluscs 34,688
Cured products 214
Others 15,936
Non food consumption 18,292
Total 73,566
Domestic consumption
Direct human consumption Kg/per capita
Total 8.7
Industrial consumption
Fish meal (MT) 82,791
Fresh fish
% catch 40
Capital goods
Domestic: -vessel building and small boat building
-fishing gears and nets
-shipyards
-ice making machinery (for ships)
Imported: -ice making machinery (for processing)
-processing equipment
-packing equipment
-storage equipment)cold chain
- spare parts
Services
Port facilities: docks
Maintenance
Ice
Repair facilities
Transport
Depots
Finance
PACKAGE

(1) Year 1983

In the last 8 years about 60 per cent of the catch has been processed. Most of the processing plants are privately owned, although in freezing plants state participation is important. However, at present para-state freezing plants for prawns are being sold to co-operatives.

The final products are of good quality, using mainly technology tested in the United States, although recent equipment imports show a tendency for more sophisticated European equipment. The freezing and fish meal factories of low capacity use domestically manufactured equipment of average quality. This situation shows the high degree of industrialization reached for this country in comparison with the rest of the group. However, the level of capacity utilization of the plants is only high for tuna (72 per cent) with a national average of 39 per cent.

Almost all the canned fish is destined for the domestic market. This product and dry, salted fish are popular in small towns and rural areas. Here, the role played by the public sector is important in the distribution of canned fish through official stores, small retailers or trade-union stores.

In contrast, shellfish go more and more for export or the domestic high income class market. In 1984 only 6.5 per cent of the total catch was exported.

The fresh fish is distributed by the private sector, on a small or medium scale, except in big cities where there are wholesale supply centres. The imports are insignificant, confined to fish meal. The direct consumption reached 10 kg/capita/year and the indirect consumption reached 5 kg/capita/year.

The government programme regards fish as one of the ten priority commodities for feeding the population. The priority given by the government is high and the financing made available to this sector has increased lately. The investment since 1977 has also increased more than 20 times. The establishment of a credit and promotion trust, with its programmes covering the whole process, has caused significant progress, especially in catch marketing and distribution.

The government is involved in all phases of activity, but with minority participation. In processing its share is about 20 per cent. The public sector accounts for between 5 and 8 per cent of the catch.

Some joint ventures exist between the government and foreign companies, although foreign participation is strictly regulated. The present economic crisis makes it imperative to adopt new policies and approaches. The three sectors involved (government, private, and social (co-operatives) sectors) in fisheries would need a lot of co-ordination and co-operation as well as foreign investment. The private sector is being approached by the fisheries authorities regarding the possibility of associating jointly on a larger scale in the ownership and/or operation of existing fisheries plants and vessels.

The main constraints to development to the Mexican FIS are the concentration of resources in two regions, the lack of infrastructure for extraction, specially for tuna and fin fish as well as for on-board handling of sardines. In the marketing sector, the lack of a cold storage network is the main constraint together with insufficient working capital and inefficient marketing organization.

Presently there is a low level of domestic consumption of fish due mainly to drops in real income and poor availability of low cost species.

Potential for development lies in large resources, good potential for agriculture, abundant supply of energy needs and the high priority given by the government to the FIS development.

5.4 Venezuela

Venezuela is the typical country from group 3, where the FIS has low priority. The countries in this group (group 3) have some fishery potential, but they have not given high priority to the development of their fishing industries. Venezuela, being traditionally a petroleum exporting country, had not completely developed the fisheries industries until the early 1980s. The fish catch grew 88 per cent from 1979 to 1985. Venezuela is in second place within the group as a fish producer.

The FIS is based upon pelagic and demersal resources. Tuna fish is important in Venezuela, which is one of the major tuna producing countries in the world.

Extraction in Venezuela increases mainly through the growth of the fleet. Investments are recent and consequently the country has a relatively modern fleet.

The canned fish industry primarily processes sardine. These plants have recently been renewed so that today a very high standard of quality has been reached.

The export component started to be important in 1983-84. Domestic consumption is relatively low, but it has shown rapid increases recently. Almost all domestic consumption is fresh fish. In second place comes canned fish. The fresh fish goes to the local market through private channels.

Most industrial inputs have had to be imported in Venezuela due to the recent and fast development of the system.

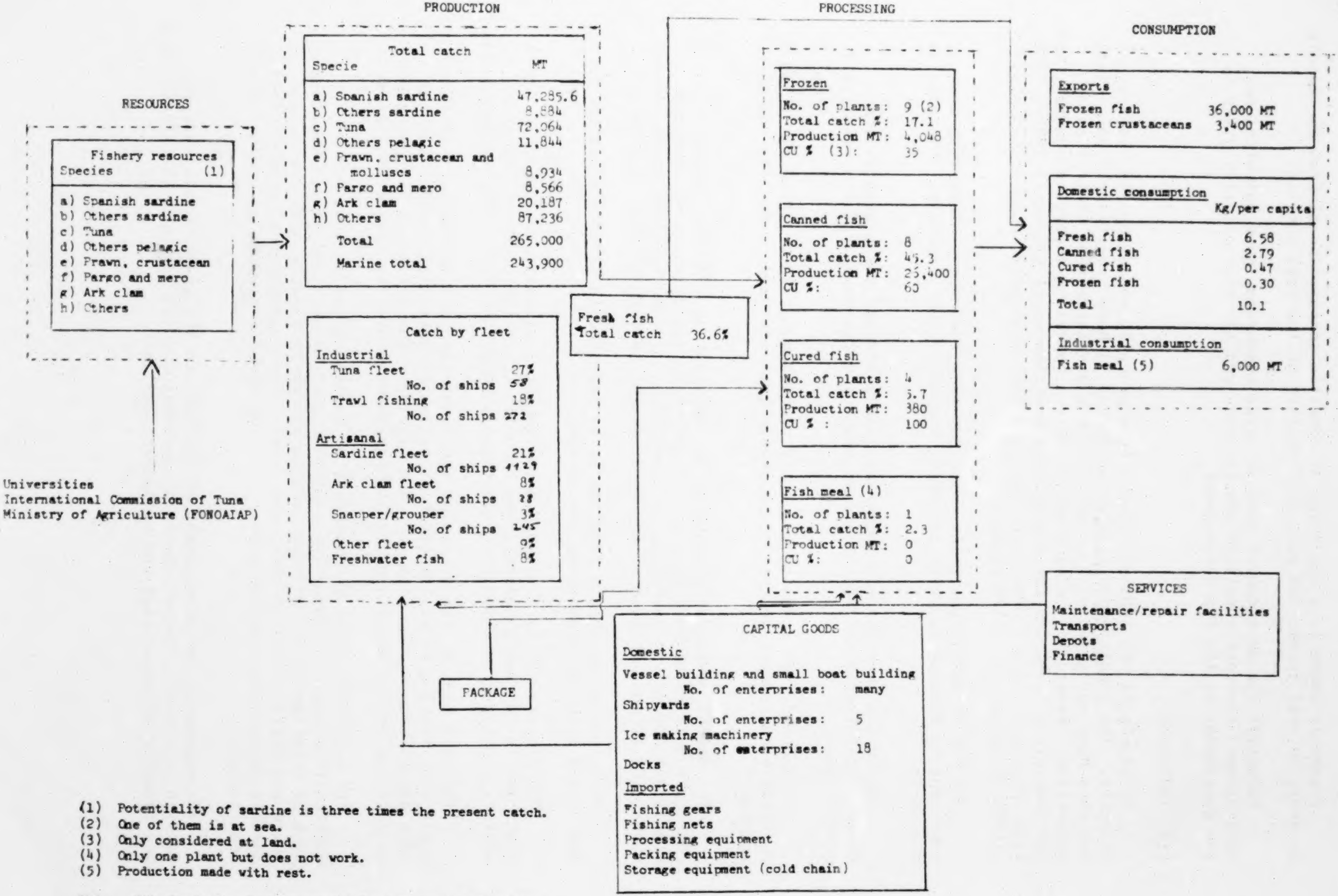
The Ministry of Agriculture is the public institution responsible for fisheries in Venezuela however, the industry is in the hands of the private sector. Foreign investment is encouraged through the joint venture mechanism.

The main constraints affecting the Venezuelan FIS development is that shelf area fishing is at its limit of estimated potential, hence, further development should come from deep-sea fishing. The artisanal fishing sector is affected by the use of inadequate equipment and lacks new technologies.

The availability of intermediate or capital goods is low, and difficulties exist in importing equipment such as nets and gear. There is a lack of interest in the private banking system to finance this sector and there are difficulties in obtaining credit from international banks. The administrative rules and policies affecting the FIS are not co-ordinated or centralized.

Enhancements for development of the FIS are the positive attitude to foreign investment, the existence of successful joint ventures that facilitate the transfer of technology and management skills.

Figure 5.4. Base diagram FIS Venezuela 1984


RESOURCES
Fishery resources
Species (1)
a) Spanish sardine
b) Others sardine
c) Tuna
d) Others pelagic
e) Prawn, crustacean
f) Pargo and mero
g) Ark clam
h) Others
Universities
International Commission of Tuna
Ministry of Agriculture (FONOAIAP)
PRODUCTION
Total catch
Specie MT
a) Spanish sardine 47,285.6
b) Others sardine 8,884
c) Tuna 72,064
d) Others pelagic 11,844
e) Prawn, crustacean and molluscs 8,934
f) Pargo and mero 8,566
g) Ark clam 20,187
h) Others 87,236
Total 265,000
Marine total 243,900
Catch by fleet
Industrial
Tuna fleet 27%
No. of ships 58
Trawl fishing 18%
No. of ships 272
Artisanal
Sardine fleet 21%
No. of ships 1129
Ark clam fleet 8%
No. of ships 28
Snapper/grouper 3%
No. of ships 245
Other fleet 9%
Freshwater fish 8%
Fresh fish
Total catch 36.6%
PACKAGE
PROCESSING
Frozen
No. of plants: 9 (2)
Total catch %: 17.1
Production MT: 4,048
CU % (3): 35
Canned fish
No. of plants: 8
Total catch %: 45.3
Production MT: 25,400
CU %: 60
Cured fish
No. of plants: 4
Total catch %: 5.7
Production MT: 380
CU % : 100
Fish meal (4)
No. of plants: 1
Total catch %: 2.3
Production MT: 0
CU %: 0
CAPITAL GOODS
Domestic
Vessel building and small boat building
No. of enterprises: many
Shipyards
No. of enterprises: 5
Ice making machinery
No. of enterprises: 18
Docks
Imported
Fishing gears
Fishing nets
Processing equipment
Packing equipment
Storage equipment (cold chain)
CONSUMPTION
Exports
Frozen fish 36,000 MT
Frozen crustaceans 3,400 MT
Domestic consumption
Kg/per capita
Fresh fish 6.58
Canned fish 2.79
Cured fish 0.47
Frozen fish 0.30
Total 10.1
Industrial consumption
Fish meal (5) 6,000 MT
SERVICES
Maintenance/repair facilities
Transports
Depots
Finance

(1) Potentiality of sardine is three times the present catch.
(2) One of them is at sea.
(3) Only considered at land.
(4) Only one plant but does not work.
(5) Production made with rest.

Note: All physical values expressed in terms of fresh fish.

In summary, Venezuela represents a group where the countries have resources, industry, infrastructure and capital to develop their fisheries. But Venezuela is one of the few in this group which has shown serious interest in the FIS.

One of the problems Venezuela has to face, as in most countries where fisheries have had low priority, is the design of institutional infrastructure in order to co-ordinate actions related to resource exploration, research, promotion and finance.

Venezuela plans to increase domestic consumption, as fish is an important source of animal proteins. For this purpose improvements in the fishing as well as in the processing and marketing components should be made.

5.5 Indonesia

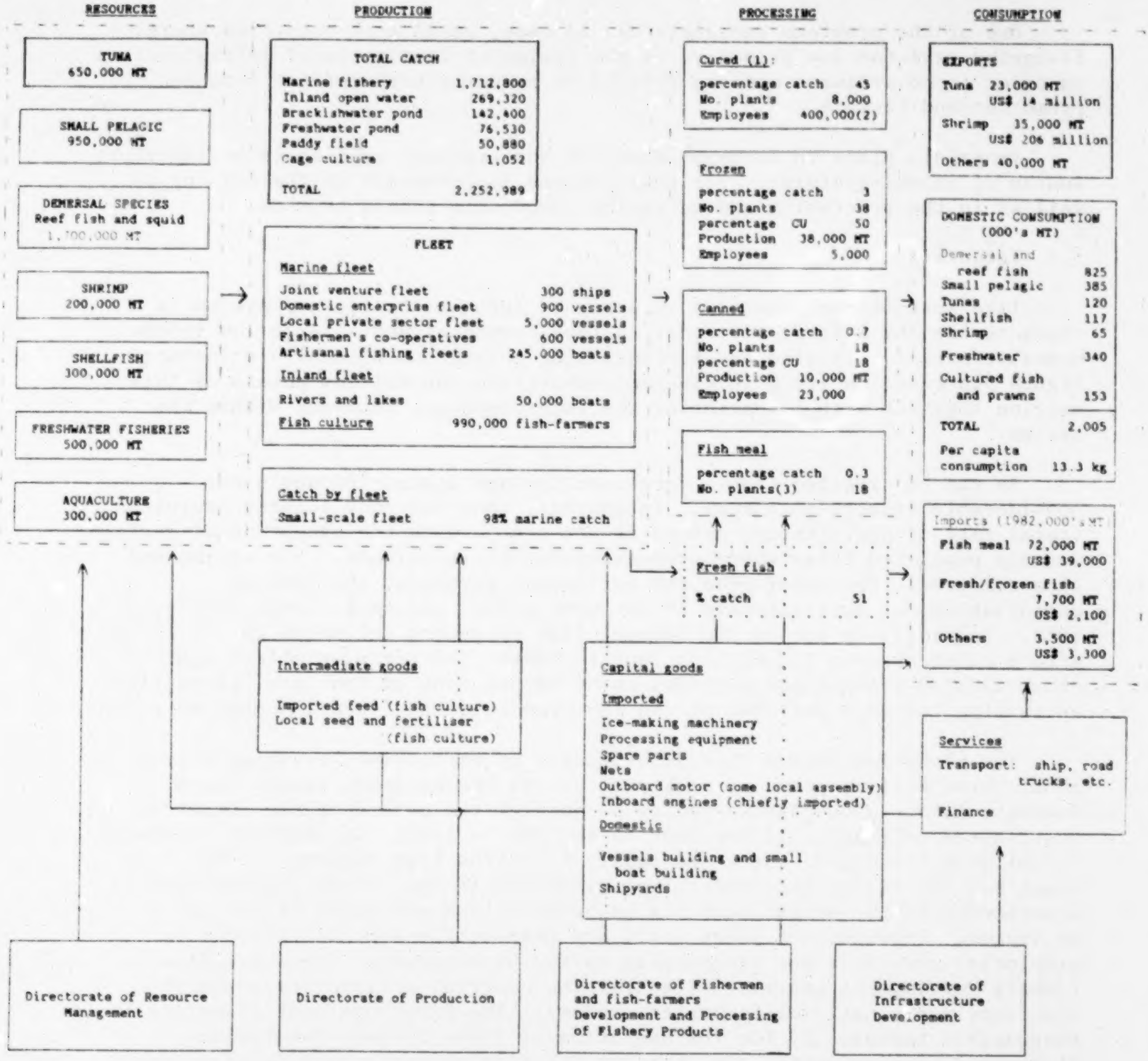
Like most of the countries in group 4, Indonesia's fishery system is characterized by a large artisanal capture component and a large low income domestic market. It also has a flourishing inland and aquaculture industry. Figure 5.5 contains its base diagram summarizing the salient points of this section together with illustrating the intercomponent linkages within the system.

As can be expected from a large archipelago state, Indonesia has considerable fishery resources. In general, they are only lightly exploited (total rate of exploitation around 28 per cent), with the exception of certain densely populated areas where over-exploitation is evident. For shrimp and tuna resources, the major products for export purposes, the rate of exploitation was approximately 69 per cent and 23 per cent, respectively, in 1982. Indonesia is one of the largest fish producers (eleventh in the world) with a catch of over 2.2 million tons in 1984. The artisanal fleet numbers about 250,000 vessels and provides about 98 per cent of the total production, accounting for 99.8 per cent of the employment in the fisheries capture sector.

The fisheries sector is a major source of employment, engaging a total of about three million persons, or 5 per cent of the national labour force. However, labour productivity is low because of the nature of the industry. It contributed only about 17 per cent to the GNP in 1983. In addition to around 1.5 million fishermen, there are nearly 1 million fish farmers in the country. The Directorate General of Fisheries is one of the largest fishery departments in the world, with six major divisions and staff in all 28 provinces. Provincial fishery staff are responsible administratively to provincial governors and technically to the Directorate. There are five fishery development centres, five training centres, a fisheries research institute and a national fisheries academy. The Directorate of Fisheries is responsible technically for the operation of State Fishery Enterprises, 21 coastal fishing ports, two interinsular fishing ports, and one deep sea fishing port.

The marine fishing industry is primarily artisanal but there are a number of large fishing companies, chiefly joint venture or state enterprises, fishing mainly for tuna or shrimp for export. Fishery co-operatives also operate or service fleets of vessels, and there is a large number of smaller commercially owned vessels. These were previously mostly trawlers but since all trawling was banned in the Java Sea and West Indonesian waters they have changed over largely to purse seine fishing for sardines.

Figure 5.5. Base diagram FIS Indonesia 1984


RESOURCES
PRODUCTION
PROCESSING
CONSUMPTION
TUNA 650,000 MT
SMALL PELAGIC 950,000 MT
DEMERSAL SPECIES Reef fish and squid 1,700,000 MT
SHRIMP 200,000 MT
SHELLFISH 300,000 MT
FRESHWATER FISHERIES 500,000 MT
AQUACULTURE 300,000 MT
TOTAL CATCH
Marine fishery 1,712,800
Inland open water 269,320
Brackishwater pond 142,400
Freshwater pond 76,530
Paddy field 50,880
Cage culture 1,052
TOTAL 2,252,989
FLEET
Marine fleet
Joint venture fleet 300 ships
Domestic enterprise fleet 900 vessels
Local private sector fleet 5,000 vessels
Fishermen's co-operatives 600 vessels
Artisanal fishing fleets 245,000 boats
Inland fleet
Rivers and lakes 50,000 boats
Fish culture 990,000 fish-farmers
Catch by fleet
Small-scale fleet 98% marine catch
Cured (1):
percentage catch 45
No. plants 8,000
Employees 400,000(2)
Frozen
percentage catch 3
No. plants 38
percentage CU 50
Production 38,000 MT
Employees 5,000
Canned
percentage catch 0.7
No. plants 18
percentage CU 18
Production 10,000 MT
Employees 23,000
Fish meal
percentage catch 0.3
No. plants(3) 18
Fresh fish
% catch 51
EXPORTS
Tuna 23,000 MT US$ 14 million
Shrimp 35,000 MT US$ 206 million
Others 40,000 MT
DOMESTIC CONSUMPTION (000's MT)
Demersal and reef fish 825
Small pelagic 385
Tunas 120
Shellfish 117
Shrimp 65
Freshwater 340
Cultured fish and prawns 153
TOTAL 2,005
Per capita consumption 13.3 kg
Imports (1982,000's MT)
Fish meal 72,000 MT US$ 39,000
Fresh/frozen fish 7,700 MT US$ 2,100
Others 3,500 MT US$ 3,300
Intermediate goods
Imported feed (fish culture)
Local seed and fertiliser (fish culture)
Capital goods
Imported
Ice-making machinery
Processing equipment
Spare parts
Nets
Outboard motor (some local assembly)
Inboard engines (chiefly imported)
Domestic
Vessels building and small boat building
Shipyards
Services
Transport: ship, road trucks, etc.
Finance
Directorate of Resource Management
Directorate of Production
Directorate of Fishermen and fish-farmers Development and Processing of Fishery Products
Directorate of Infrastructure Development

Inshore artisanal boats use gill nets, lines and small seines or traps. The majority of the canoes are un-mechanized but some are driven by power pole motors, outboard engines or small inboard diesels.

Fish farming is chiefly in brackish water and produces milkfish or prawns. Freshwater fish farms produce a variety of species of which Chinese carp is probably the most popular and marketable. A network of extension services and government hatcheries service the aquaculture industry.

The country is well equipped with boatyards and still has tropical hardwoods available for boat building. Local workshops, however, require upgrading to improve deck machinery, stern gear alignment and introduce hydraulics. Vessel hold insulation also merits attention.

Fish exports, chiefly shrimp and tuna, currently earn nearly US$ 250 million a year, but in volume they are a small part of the total production, 95 per cent of which is sold and consumed locally. About half of the marine landings destined for domestic consumption are processed into dried and salted products with smaller quantities being smoked, canned or boiled in brine. The majority of these processing activities takes place at the cottage industry level.

The other half of the marine landing is offered in fresh state to the consumer. The volume of fresh (and frozen) fish supplies is gradually increasing due to the introduction of more modern facilities such as ice-making, freezing and cold storage equipment.

Fish has traditionally been the principal source of animal protein in the Indonesian diet. Fish provides about 62 per cent of the domestic animal protein supply, followed by meat (23 per cent), dairy products and eggs (15 per cent). Due to the uneven distribution of the population, per capita consumption varies greatly from area to area. The average annual per capita consumption of fish was 13.5 kg in 1984. Per capita fish consumption is highest near the coast or around fish landing places. Jakarta, with over 6.5 million population, is the largest single urban market for fish, and the bulk of fish movement within the country is towards the capital. There is some export of fresh fish to Singapore, particularly from the Irian islands nearby. The major market for Indonesian products, however, is Japan. This is the result of the involvement of the many Japanese joint ventures and of its proximity to Japan. The United States and Europe are the next major outlets.

Marketing procedures vary from place to place. In general, fresh fish is sold by local fish dealers operating fixed location shops. Salted fish outlets are mostly in the vicinity of the consumers' homes. Dried, salted, boiled-in-brine and fermented fish products remain extremely important in the national fish supply/consumption picture due to their popularity, low price, and easy storage and transport. Both pelagic and demersal fish are used as raw materials. Boiling in salt solution is very popular for short-term preservation. Due to the poor process technology and hygiene practices observed, cured fish products in Indonesia deteriorate rather rapidly.

In the case of fish canning, canners utilize pelagic fish almost exclusively, particularly oil sardines. Fish meal production usually takes place in conjunction with canning and new and bigger canneries are being planned, mainly for tuna canning. However, there is an insufficient supply to local tuna canning companies, since producers prefer to export frozen tuna to canneries abroad because of better prices and payment in foreign currency.

An inspection and quality control programme for both domestic consumption and export products has been established. The main work of inspection laboratories, however, is to certify frozen shrimp and frozen tuna for export.

Ice plants are located at all the main fish landing places though their efficiency varies and there is a need to improve water quality. The most commonly used freezing methods in the country are air blast and contact plate freezing. The plants have only about 50 per cent capacity utilization.

The government recognizes that geographic distribution and capacity of existing fishing ports, fish landing sites, ice plants, cold storage and freezing facilities, boat building and repair facilities and other support services are inadequate to facilitate the required expansion of fish production, domestic suppliers and export in an efficient and cost effective manner. A current US$ 70 million Asian Development Bank-financed project aims to develop infrastructure and facilities at a number of major fishing ports.

Indonesia plans to expand its marine industries and merchant, naval and fishing fleets. A current programme plans for the construction of thousands of vessels and the upgrading of local boatyards and shipyards. The government plans to expand fisheries production both to meet domestic needs and to boost exports. The domestic supply will have to rise to meet the growing population and also to raise per capita fish consumption, which is a national nutrition goal.

These points are summarized and inter-component linkages illustrated in the base diagram in figure 5.5.

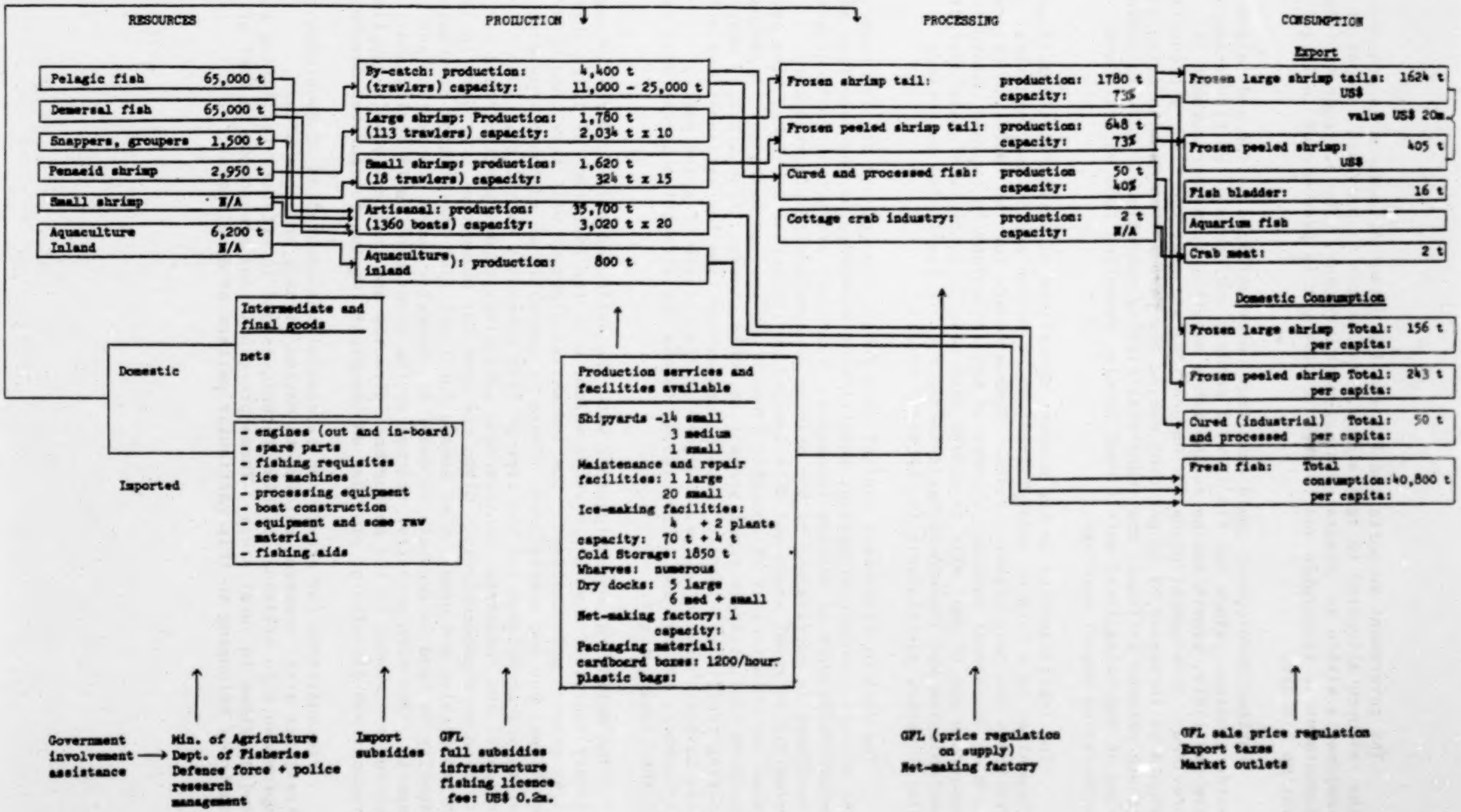
5.6 Guyana

Guyana, one of the small states, but with growth potential, is really an important example of group 5. It presents a relatively simple FIS addressed to human consumption, as illustrated by the base diagram. The FIS, however simple, is well structured and relatively well managed as illustrated by the presence of an adequate services and facilities component and a relatively high level of capacity utilization. It is a small country with as high a growth potential for the FIS as the rest of the group.

Only 20 per cent of the MSY is being exploited, although in the 1970s a certain degree of over-exploitation of large fish was experienced. The predominance of the artisanal sector in the extraction component (another characteristic of group 5) is well illustrated by the case of Guyana. While the artisanal sector serves the domestic fresh fish market (90 per cent of fish consumed in the country) the industrial fleet specializes in shrimp for the export market. Guyana is one of the few shrimp fishing countries that promotes the utilization of shrimp by-catch.

There is high dependence on imported industrial inputs, with the exception of nets but production services and facilities have been made available by consistent government policies. Group 5 is characterized by a high domestic consumption and this is well illustrated by the case of Guyana (41.6 kg/capita/year) where fish contributes with 40 per cent of the total animal protein consumption. However, since the population is small in Guyana (as in the rest of the countries of this group) important expansion of the FIS should mainly come from increases in the export market.

Figure 5.6. Base diagram FIS Guyana 1985


RESOURCES
PRODUCTION
PROCESSING
CONSUMPTION
Pelagic fish 65,000 t
Demersal fish 65,000 t
Snappers, groupers 1,500 t
Penaeid shrimp 2,950 t
Small shrimp N/A
Aquaculture Inland 6,200 t N/A
By-catch: production: 4,400 t
(trawlers) capacity: 11,000 - 25,000 t
Large shrimp: Production: 1,780 t
(113 trawlers) capacity: 2,034 t x 10
Small shrimp: production: 1,620 t
(18 trawlers) capacity: 324 t x 15
Artisanal: production: 35,700 t
(1360 boats) capacity: 3,020 t x 20
Aquaculture inland): production: 800 t
Frozen shrimp tail: production: 1780 t capacity: 73%
Frozen peeled shrimp tail: production: 648 t capacity: 73%
Cured and processed fish: production 50 t capacity: 40%
Cottage crab industry: production: 2 t capacity: N/A
Export
Frozen large shrimp tails: 1624 t US$
value US$ 20m.
Frozen peeled shrimp: 405 t US$
Fish bladder: 16 t
Aquarium fish
Crab meat: 2 t
Domestic Consumption
Frozen large shrimp Total: 156 t per capita:
Frozen peeled shrimp Total: 243 t per capita:
Cured (industrial) and processed Total: 50 t per capita:
Fresh fish: Total consumption: 40,800 t per capita:
Intermediate and final goods
nets
Domestic
Imported
- engines (out and in-board)
- spare parts
- fishing requisites
- ice machines
- processing equipment
- boat construction
- equipment and some raw material
- fishing aids
Production services and facilities available
Shipyards -14 small
3 medium
1 small
Maintenance and repair facilities: 1 large
20 small
Ice-making facilities: 4 + 2 plants
capacity: 70 t + 4 t
Cold Storage: 1850 t
Wharves: numerous
Dry docks: 5 large
6 med + small
Net-making factory: 1
capacity:
Packaging material:
cardboard boxes: 1200/hour
plastic bags:
Government involvement assistance
Min. of Agriculture
Dept. of Fisheries
Defence force + police
research
management
Import subsidies
GFL
full subsidies
infrastructure
fishing licence fee: US$ 0.2m.
GFL (price regulation on supply)
Net-making factory
GFL sale price regulation
Export taxes
Market outlets

The government supports the FIS and its direct allocation is one-third of the resource allocated to agriculture. Assistance is provided to most of the components within an integrated management approach. The attitude to foreign investment is favourable and foreign involvement is predominant in large shrimp fishery.

Further development could come from under-utilized marine and inland water species. Since the FIS is well managed and unexploited fish resources are available, growth may be accomplished smoothly if proper support is provided. Development plans for Guyana indicate that the fishery production should be increased by 22 per cent during the period 1986-89 with balanced growth between artisanal and industrial fishing operations. This increase aims at improving local nutritional levels, promoting food security and stimulating export earnings.

The inefficiencies in the present operations of Guyana's FIS manifest themselves in a form of underutilization of marine and inland fisheries resources and post harvest losses. Common causes for the inefficiency are lack of investment capital, absence of new technology to exploit underutilized resources and to deal with by-catch, lack of skilled professionals appropriate technologies and inadequate basic infrastructure facilities to service distribution, particularly in the rural areas.

The lack of investment capital both public and private has its cause in the overall economic situation, insufficient knowledge of the resources and unfavourable view of foreign investors. Increased production from current investment is constrained by the absence of some basic infrastructure primarily in rural areas and deficiencies in industrial services. The primary cause for this is lack of domestic finance and foreign exchange. Inadequate on-shore facilities in rural areas (ice, cold storage, fish storage, wharves, docking facilities) lead to loss in turn around time for artisanal boats and also to post harvest losses. Reduced availabilities of spare parts, replacement engines and other fishing requisites affect the operational status of the fishing fleet.

The marine resources together with the estimated potential for inland fishery represent a valuable asset which, with the exception of large shrimp, is at present underutilized. The industrial fleet is well developed and perational but too specialized. There is generally an adequate knowledge of harvesting techniques for the type of fish presently extracted. Both artisanal and industrial sectors have sufficient capacity which could be utilized more productively. Given the need for managerial practices in large shrimp fishing and unsatisfied demand for fresh fish the present processing capacity on land is adequate to cater for domestic human consumption and exports. The high priority attached by the Government to fisheries and its active involvement in the sector both directly and indirectly as a supplier, producer and distributor provides an important impetus for further development.

Preconditions for growth and successful implementation of development strategies are: research related to marine fishing and aquaculture, improvements in artisanal fishing techniques and in offshore facilities at landing sites in rural areas. These pre-conditions are common to most of the countries belonging to this particular pattern of development.

5.7 Peru

Peru belongs to group 6. The first characteristic of this group is the fluctuating resource. Peru's catch has varied between 12 million tons and its present level of 3 million tons. In addition, most of the present catch consists of sardines, whereas in the 1960s and early 1970s it was based mainly on the anchovy.

In general the fish resources in Peru are under-exploited, basically because of lack of biological knowledge of the species.

The extraction component is characterized by the low use of the installed capacity of the fleet. In addition to the excess of installed capacity, there is a lack of infrastructure and technology to catch demersal species by trawlers. That is why the pelagic resource is the most important in Peru.

The second important characteristic of this group is the large industrial processing infrastructure. Peru has a very high proportion of fish meal for animal feed (approximately 88 per cent in 1984). Also it has a large installed capacity due to a massive over-investment in the fish meal industry during the anchovy fishery, and in the canning industry, as a consequence of the disordered growth experienced during the late 1970s and early 1980s. There are indications that the large installed capacity will not be used again because of ecologic changes which occurred in the Peruvian Sea.

The frozen processing capacity is also under-utilized at present, because of low international prices.

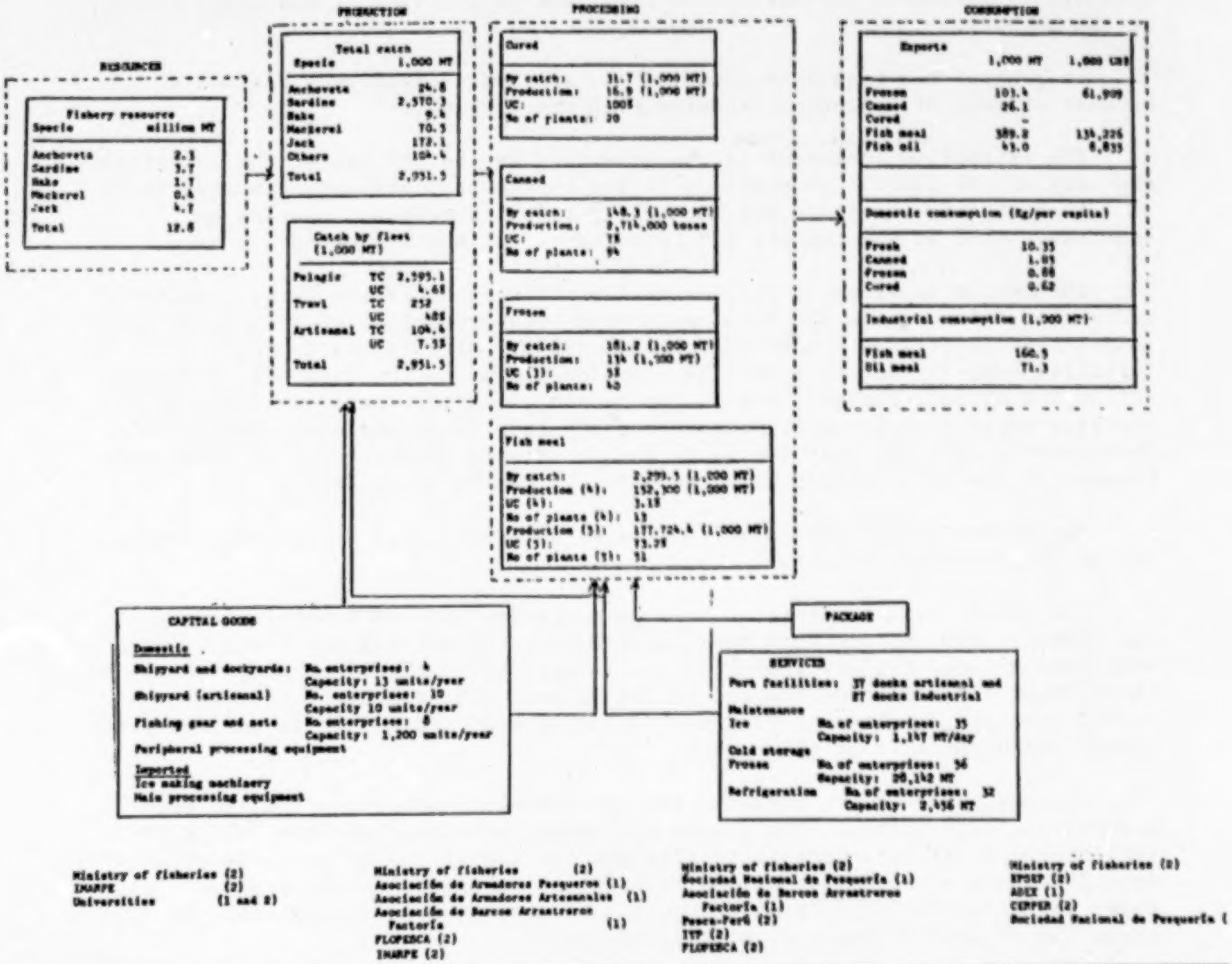
The third characteristic of this group is the limited domestic demand. The domestic consumption from Peru is on average relatively low for a country with such a large fishery exploitation. Almost all domestic consumption is in the form of fresh fish as opposed to the 86 per cent frozen, 56 per cent canned fish and 71 per cent fish meal which is exported. This is an important common characteristic of this group.

Fishery products are marketed through a public enterprise (called EPSEP) and private enterprises. The status of industrial inputs for the FIS in Peru reflect the level of industrialization and the conditions of Latin American countries (and consequently of the majority of countries in the group), i.e., capacity for producing a large proportion of the required inputs with the exception of sophisticated processing equipment.

The canning industry operates with high fixed costs, which is one reason for its low competitiveness. In addition, this industry is affected by low international prices of end products. The curing industry has no importance at present, but has a promising future. The FIS in Peru is especially important because fish products account for one-third of the total consumption of animal proteins and also because this system provides roughly 10 per cent of the total foreign exchange revenue. But in general, the resource allocation to fisheries does not constitute a high proportion of the total budget.

The Ministry of Fisheries is the public institution in charge of the fisheries in Peru. However, there are some other public institutions involved as well as private organizations. In general the government has a high participation in the different components of the fisheries system.

Figure 5.7. Base diagram FIS Peru 1984


RESOURCES
Fishery resource
Specie million MT
Anchoveta 2.3
Sardine 3.7
Hake 1.7
Mackerel 0.4
Jack 4.7
Total 12.8
PRODUCTION
Total catch
Specie 1,000 MT
Anchoveta 24.8
Sardine 2,570.3
Hake 9.4
Mackerel 70.5
Jack 172.1
Others 104.4
Total 2,951.5
Catch by fleet (1,000 MT)
Pelagic TC 2,595.1
UC 4.6%
Trawl TC 252
UC 48%
Artisanal TC 104.4
UC 7.3%
Total 2,951.5
PROCESSING
Cured
By catch: 31.7 (1,000 MT)
Production: 16.9 (1,000 MT)
UC: 100%
No of plants: 20
Canned
By catch: 148.3 (1,000 MT)
Production: 2,714,000 boxes
UC: 7%
No of plants: 94
Frozen
By catch: 181.2 (1,000 MT)
Production: 134 (1,000 MT)
UC (3): 5%
No of plants: 42
Fish meal
By catch: 2,293.3 (1,000 MT)
Production (4): 152,300 (1,000 MT)
UC (4): 3.1%
No of plants (4): 13
Production (5): 177,724.4 (1,000 MT)
UC (5): 73.2%
No of plants (5): 51
CONSUMPTION
Exports
1,000 MT 1,000 US$
Frozen 103.4 61,909
Canned 26.1
Cured -
Fish meal 389.2 134,226
Fish oil 43.0 8,835
Domestic consumption (Kg/per capita)
Fresh 10.33
Canned 1.03
Frozen 0.88
Cured 0.62
Industrial consumption (1,000 MT)
Fish meal 160.5
Oil meal 71.3
CAPITAL GOODS
Domestic
Shipyard and dockyards: No. enterprises: 4
Capacity: 13 units/year
Shipyard (artisanal) No. enterprises: 10
Capacity 10 units/year
Fishing gear and nets No. enterprises: 8
Capacity: 1,200 units/year
Peripheral processing equipment
Imported
Ice making machinery
Main processing equipment
PACKAGE
SERVICES
Port facilities: 37 docks artisanal and 27 docks industrial
Maintenance
Ice No. of enterprises: 33
Capacity: 1,147 MT/day
Cold storage
Frozen No. of enterprises: 36
Capacity: 20,142 MT
Refrigeration No. of enterprises: 32
Capacity: 2,456 MT
Ministry of fisheries (2)
IMARPE (2)
Universities (1 and 2)
Ministry of fisheries (2)
Asociación de Armadores Pesqueros (1)
Asociación de Armadores Artesanales (1)
Asociación de Barcos Arrastreros Factoría (1)
FLOPESCA (2)
IMARPE (2)
Ministry of fisheries (2)
Sociedad Nacional de Pesquería (1)
Asociación de Barcos Arrastreros Factoría (1)
Pesca-Perú (2)
ITP (2)
FLOPESCA (2)
Ministry of fisheries (2)
EPSEP (2)
ADEX (1)
CERPER (2)
Sociedad Nacional de Pesquería (

TC: Total catch
UC: Utilization of installed capacity

IMARPE: Instituto del Mar del Perú
ITP: Instituto Tecnológico Pesquero

(1) Private institution
(2) Public institution

(3) Inland facilities
(4) Pesca-Perú, 1984
(5) Private enterprises

Two public enterprises actively participate in the extraction process, the rest are associated private enterprises. In the processing components the state has the monopoly in the processing of whole fish into fish meal. Private enterprises are only allowed to make fish meal from the residue of the processed fish from other activities such as canning, freezing and curing. Another public enterprise also exists to commercialize specially frozen fish.

The high participation of the government is not necessarily a characteristic of the group, but it is important in Peru.

One of the main constraints of the Peruvian FIS is the fluctuating resource, together with a lack of systematic scientific research of the marine resources. The fleet is obsolete and underutilized. Freezing, canning and fish meal manufacturing industries are over dimensioned affecting negatively the economic efficiency of the FIS system.

The markets are limited by international prices (the case of the frozen products) as well as by low internal demand due to low income and lack of awareness on the part of the consumer for processed fish products.

Peru has a good potential for expansion of the internal and export market and the general availability of industrial inputs is acceptable.

Peru wishes to increase the export trade: the production of fish meal, which already constitutes a source for foreign exchange, should be given special attention in this respect. The domestic market is another area which Peru wishes to develop through increasing the frozen fish supply as well as promoting the cured fish industry. The artisanal fishery should be assisted through improving the existing infrastructure.

5.8 Philippines[21/]

The Philippine fishing industry, though largely artisanal, has a strong private, commercial sector, both in the marine and the aquaculture areas. Although the government accords high priority to fisheries and allocates considerable resources to its administration and development, it is chiefly from commercial or business interests that the industry derives its impetus. This is a common feature of countries in group 7.

The Philippine fishing industry has an important role in the economy. In 1985 the fisheries sector employed approximately one million persons, of which 22 per cent were in inland waters and the rest in marine fisheries. A large share of the labour force is connected with the artisanal fisheries subsector. Fish is the main and cheapest source of animal protein, representing 62 per cent of total animal protein intake.

In figure 5.8, the base diagram illustrates a relatively simple system with three main production sectors: the marine municipal (or artisanal), the marine commercial, and the aquaculture sector. The bulk of the fish catch (62 per cent) is taken by artisanal fishermen who operate mostly from outriggger canoes known as "barcas". Some larger outrigger "pump" boats are used in pelagic fishing with lift nets or purse seines. The smaller canoes,

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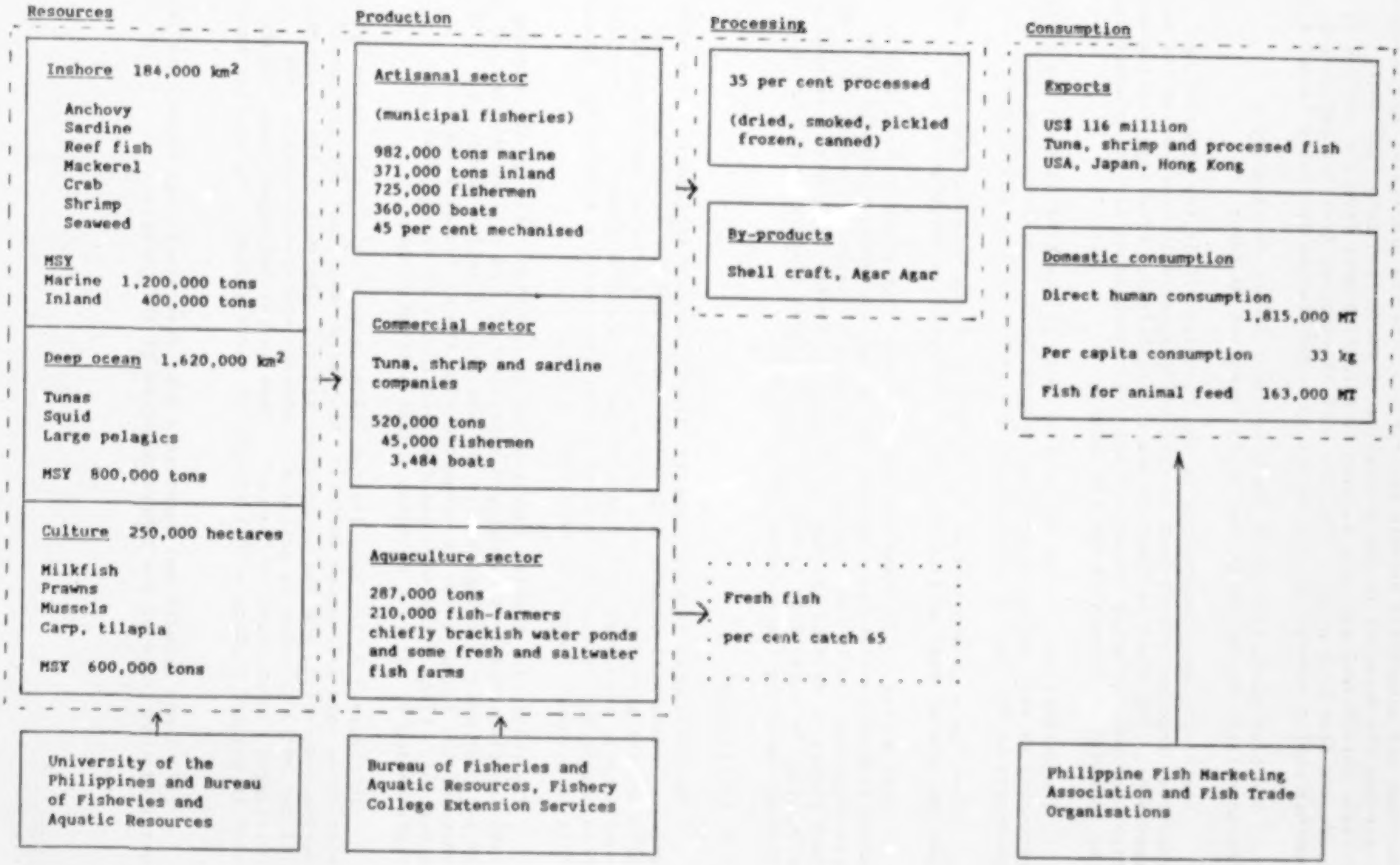
21/ These results are based on a mini case study and, hence, are less detailed than those of the other countries of this chapter.

Figure 5.8. Base diagram FIS Philippines 1984


Resources
Inshore 184,000 km²
Anchovy
Sardine
Reef fish
Mackerel
Crab
Shrimp
Seaweed
MSY
Marine 1,200,000 tons
Inland 400,000 tons
Deep ocean 1,620,000 km²
Tunas
Squid
Large pelagics
MSY 800,000 tons
Culture 250,000 hectares
Milkfish
Prawns
Mussels
Carp, tilapia
MSY 600,000 tons
University of the Philippines and Bureau of Fisheries and Aquatic Resources
Production
Artisanal sector
(municipal fisheries)
982,000 tons marine
371,000 tons inland
725,000 fishermen
360,000 boats
45 per cent mechanised
Commercial sector
Tuna, shrimp and sardine companies
520,000 tons
45,000 fishermen
3,484 boats
Aquaculture sector
287,000 tons
210,000 fish-farmers
chiefly brackish water ponds and some fresh and saltwater fish farms
Bureau of Fisheries and Aquatic Resources, Fishery College Extension Services
Processing
35 per cent processed
(dried, smoked, pickled frozen, canned)
By-products
Shell craft, Agar Agar
Fresh fish
per cent catch 65
Consumption
Exports
US$ 116 million
Tuna, shrimp and processed fish
USA, Japan, Hong Kong
Domestic consumption
Direct human consumption 1,815,000 MT
Per capita consumption 33 kg
Fish for animal feed 163,000 MT
Philippine Fish Marketing Association and Fish Trade Organisations

many of which are mechanized, use mainly lines or gill nets. The municipal fishermen are distributed around the country in villages or "barrios", though the majority are found in the Visayan islands which form the centre of the archipelago. There is relatively less fishing from the main island of Luzon in the north although the major fish market exists there in the Metro Manila area.

The commercial fleets can be classified into three groups: baby trawlers, lift net boats, and tuna purse seiners. The "baby" trawlers work inshore for shrimp, the lift net boats for sardine and anchovy, and the purse seiners fish offshore in deeper waters for tuna. There is considerable friction between the commercial trawlers and lift net boats, and artisanal fleets on the heavily exploited inshore grounds. Current legislation is designed to protect the local small scale fishermen, but it is rarely enforced. The tuna fleets, however, do not compete directly with local fishermen as they fish offshore and often employ them to help catch large tuna with deep drop lines or to trap tuna schools in bays with stop seines.

Commercial companies or fish merchants also operate fish carrier vessels which play an important part in supplying the large Navotas (Manila) market with fish from the Visayas and Palawan. Navotas is a large and well organized fish market which operates on a "whispered bid" type of auction. Per capita consumption of fish is over 33 kilograms, of which 77 per cent is fresh fish and the remainder cured. The geographic distribution, and therefore consumption of fish, however, is extremely unevenly spread due to a variety of factors, one of which, perhaps, is a poor network infrastructure. The more expensive varieties are consumed by high income groups in the city. Most of the people use dried anchovies known as "dillies" or milkfish known as "bangus".

Most aquaculture takes place in brackish water ponds around the islands. These were used chiefly for milkfish in the past but are being utilized more for higher value shrimp now. Many of the ponds are large and whole areas of mangrove forests have been cleared to construct them. The impact of these developments on the coastal environment is causing much concern as is the decreasing access of local people to the shoreline. Pollution is also a problem both from industrial (mining) effluents and from chemical poisons used to clear out new fish ponds. Coral reefs have suffered from over exploitation to supply the tourist trade and from dynamite fishing which is still practised in some areas.

Laguna de Baz, a large, shallow, freshwater lake on the east side of Manila city is a source of much fish but is now so over-crowded with fish pens and suffering from pollution that production is unlikely to be maintained despite many efforts to solve the complex problems.

In the last ten years, Philippine fish production has increased at the relatively high average annual rate of 4.7 per cent. There is a flourishing trade in fishery by-products for the tourist industry based largely on capis shells and macrame. Cottage type industries also produce fish sauces and pickles which are readily marketable.

Fish exports consist mainly of shrimp and tuna. Some dried products (squid, anchovy) and fish pastes are also exported. In 1984 fish exports were valued at over US$ 116 million.

Fisheries are administered by the Bureau of Fisheries and Aquatic Resources, which is currently in the Ministry of Agriculture. The new government is presently reorganizing the administration and so institutional changes are to be expected. A new five-year fishery development plan is to be produced in 1987. Training and education in fisheries is well provided for by a network of fishery schools and colleges.

These points are summarized in figure 5.8 together with presentation of how the various system's components are linked.

5.9 Somalia

Somalia belongs to group 8, characterized by low industrialization. It has substantial marine fish resources but has neither the industry nor the fleet to exploit them. Somalia catches only 10 per cent of its potential.

Somalia reflects perfectly the lack of industry in the countries of group 8. The fish caught by the industrial fleet, when active, is invariably processed onboard at sea. This consists of sorting, grading and freezing for storage in freezer holds. Then it is either carried to the export market by the fishing vessel, or directly transferred at sea to a carrier vessel for export.

There are three canning factories in Somalia but one of them is closed and the others are old and small and produce no more than a few hundred tons per annum.

On the north coast, there is a cold store and freezing facility that has never been operational. Only one cold store exists with a capacity of 900 tons and another with a capacity of 400 tons is being built.

Salting and drying are the main forms of processing for artisanal fishing. Some of the product is used for local consumption, but much is exported. This processing is carried out with virtually no industrial input.

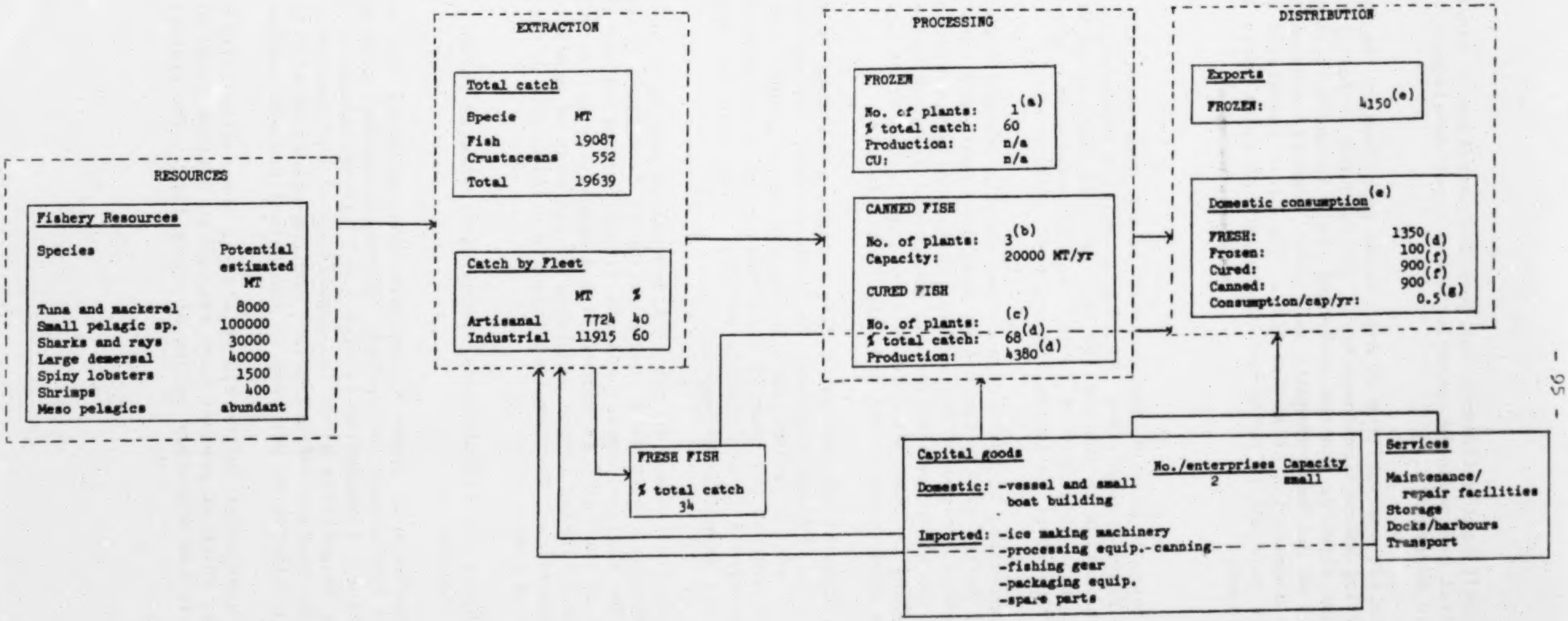
Consumption of fish is too low - only 0.2 kg/capita/year. Apart from the difficulties found in distributing fish to the inland population there has generally been a social and cultural dislike for fish.

In general, Somalia suffers from a lack of inputs and services and has a deficient infrastructure. As the government is involved from the subsistence activities to the largest trawler, it is the major single influencing factor in the fishing industry.

The government has been the sole owner of the industrial fishing fleet and the sole joint venture partner with foreign entities. The state controls the sale of fish and the export of dried fish through a parastatal company. Government policy is changing to allow greater privatization which has had the immediate effect of improving viability for smaller enterprises. The co-operatives are the basis of artisanal fisheries organization.

The fisheries sector has been given high priority by the government. However, the inoperative industrial fleet, artisanal vessels, canneries and cold stores are areas where more intensive measures would be required to develop the FIS.

Figure 5.9. Base diagram FIS Somalia 1984


RESOURCES
Fishery Resources
Species
Potential estimated MT
Tuna and mackerel 8000
Small pelagic sp. 100000
Sharks and rays 30000
Large demersal 40000
Spiny lobsters 1500
Shrimps 400
Meso pelagics abundant
EXTRACTION
Total catch
Specie MT
Fish 19087
Crustaceans 552
Total 19639
Catch by Fleet
MT %
Artisanal 7724 40
Industrial 11915 60
FRESH FISH
% total catch 34
PROCESSING
FROZEN
No. of plants: 1(a)
% total catch: 60
Production: n/a
CU: n/a
CANNED FISH
No. of plants: 3(b)
Capacity: 20000 MT/yr
CURED FISH
No. of plants: (c)
% total catch: 68(d)
Production: 4380(d)
DISTRIBUTION
Exports
FROZEN: 4150(e)
Domestic consumption(e)
FRESH: 1350(d)
Frozen: 100(f)
Cured: 900(f)
Canned: 900(f)
Consumption/cap/yr: 0.5(g)
Capital goods
No./enterprises Capacity
Domestic: -vessel and small boat building 2 small
Imported: -ice making machinery
-processing equip.-canning
-fishing gear
-packaging equip.
-spare parts
Services
Maintenance/ repair facilities
Storage
Docks/harbours
Transport

(a) Fish caught by the industrial fllet is processed on-board at sea and directly exported. One plant also exists on land (Kismaio); in 1982 it was estimated that some 280 tons were processed and exported.

(b) Since 1980 it is reported that the canneries are longer active.

(c) A large number of individuals and 20 co-operatives exist.

(d) Approximate.

(e) Year 1980.

(f) An unidentified amount of this was exported.

(g) In the capital Mogadishu the annual per capita consumption was estimated at 1.24 Kg. in 1983.

The most significant deficiency has been the inability to generate funds to keep the capital equipment in operation and a clear development strategy for the FIS would be required.

The inconsistent availability of high value resources is the main constraint affecting extraction component. The resource is far removed from infrastructure and services and the marketing chain is not well served. The processing plants do not have adequate services. Domestic consumption is very low and there is a general dislike for fish. The basic industrial infrastructure is poor and is reflected in the lack of spare parts and rudimentary equipment.

5.10 Senegal

Senegal belongs to group 9, the group of likely exporters, and is one of Africa's leading fishing countries. Fishing activities represent a 5.7 per cent contribution to the GDP (60 per cent from industrial V.A.), with an average annual rate of growth of 13 per cent compared with 5 per cent in agriculture and 9 per cent in cattle farming (1964-82).

The FIS is addressed to human consumption and the process component serves the export market with a small fish meal component (see base diagram). The Senegalese waters are one of the richest in the world (pelagic and demersal). There is a good monitoring and management resource system. However, over-fishing of demersal species close to coastal areas has taken place. There are good research and training facilities.

The growth potential for Senegal's FIS is high, a characteristic of the countries in group 9. Presently Senegal's catch is 50-60 per cent of its MSY. The artisanal sector is important in the FIS as in group 5 and in Senegal represents over 60 per cent of total marine catch and provides 90 per cent of employment in the fishing sector. It is also the major supplier of fish for domestic consumption.

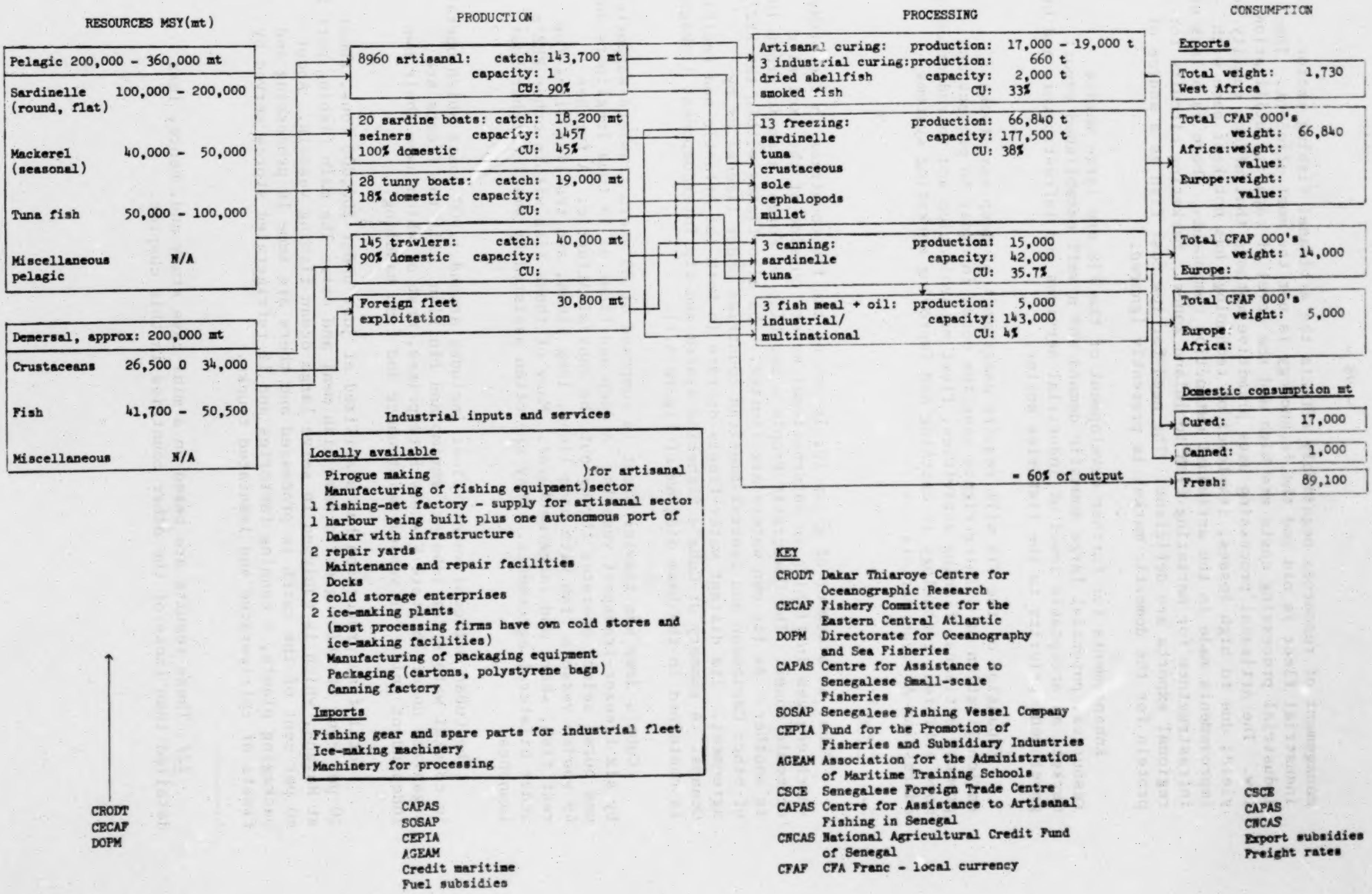
The industrial fleet has a 70 per cent Senegalese component and specializes in exports. There is a fragmentation of Senegalese producers in export markets. The regional market absorbs 57 per cent of volume exports. About 60 per cent of the catch is processed and almost the entire output is exported, with the artisanal sector supplying 15 per cent of domestic fish production for processing. The level of capacity utilization in the processing sector is low.

Industrial inputs for the artisanal sector are produced locally but all other inputs are imported.

As is characteristic of group 9, the government attaches high priority to the sector but its involvement is limited. Financial schemes give priority to the industrial sector. Consumption is high (24.5 kg/capita/year). Increases in consumption may be possible given the population of the country but improvements in distribution infrastructure and communication will be required. Fish contributes 50 per cent to the animal protein supply.

An important constraint to the FIS relates to the availability of exportable species, which at present have reached an optimum level of exploitation, and to the migratory nature of tunny fish. The present

Figure 5.10. Base diagram FIS Senegal 1983


RESOURCES MSY(mt)
PRODUCTION
PROCESSING
CONSUMPTION
Pelagic 200,000 - 360,000 mt
Sardinelle (round, flat) 100,000 - 200,000
Mackerel (seasonal) 40,000 - 50,000
Tuna fish 50,000 - 100,000
Miscellaneous pelagic N/A
Demersal, approx: 200,000 mt
Crustaceans 26,500 0 34,000
Fish 41,700 - 50,500
Miscellaneous N/A
8960 artisanal: catch: 143,700 mt capacity: 1 CU: 90%
20 sardine boats: catch: 18,200 mt seiners capacity: 1457 100% domestic CU: 45%
28 tunny boats: catch: 19,000 mt 18% domestic capacity: CU:
145 trawlers: catch: 40,000 mt 90% domestic capacity: CU:
Foreign fleet exploitation 30,800 mt
Artisanal curing: production: 17,000 - 19,000 t
3 industrial curing: production: 660 t capacity: 2,000 t CU: 33%
dried shellfish
smoked fish
13 freezing: production: 66,840 t capacity: 177,500 t CU: 38%
sardinelle
tuna
crustaceous
sole
cephalopods
mullet
3 canning: production: 15,000 capacity: 42,000 CU: 35.7%
sardinelle
tuna
3 fish meal + oil: production: 5,000 capacity: 143,000 CU: 4%
industrial/ multinational
= 60% of output
Exports
Total weight: 1,730 West Africa
Total CFAF 000's weight: 66,840 Africa: weight: value: Europe: weight: value:
Total CFAF 000's weight: 14,000 Europe:
Total CFAF 000's weight: 5,000 Europe: Africa:
Domestic consumption mt
Cured: 17,000
Canned: 1,000
Fresh: 89,100
Industrial inputs and services
Locally available
Pirogue making)for artisanal
Manufacturing of fishing equipment)sector
1 fishing-net factory - supply for artisanal sector
1 harbour being built plus one autonomous port of Dakar with infrastructure
2 repair yards
Maintenance and repair facilities
Docks
2 cold storage enterprises
2 ice-making plants
(most processing firms have own cold stores and ice-making facilities)
Manufacturing of packaging equipment
Packaging (cartons, polystyrene bags)
Canning factory
Imports
Fishing gear and spare parts for industrial fleet
Ice-making machinery
Machinery for processing
CRODT
CECAF
DOPM
CAPAS
SOSAP
CEPIA
AGEAM
Credit maritime
Fuel subsidies
CSCE
CAPAS
CNCAS
Export subsidies
Freight rates

KEY

CRODT	Dakar Thiaroye Centre for Oceanographic Research
CECAF	Fishery Committee for the Eastern Central Atlantic
DOPM	Directorate for Oceanography and Sea Fisheries
CAPAS	Centre for Assistance to Senegalese Small-scale Fisheries
SOSAP	Senegalese Fishing Vessel Company
CEPIA	Fund for the Promotion of Fisheries and Subsidiary Industries
AGEAM	Association for the Administration of Maritime Training Schools
CSCE	Senegalese Foreign Trade Centre
CAPAS	Centre for Assistance to Artisanal Fishing in Senegal
CNCAS	National Agricultural Credit Fund of Senegal
CFAF	CFA Franc - local currency

management of resources negatively affects the artisanal fishing sector. The industrial fleet is old and the technology is not the most eficient. The industrial processing costs are high and the level of capacity utilization is low. The artisanal processing uses primitive methods that affect quality and yield; due to high losses, its level of technology has not kept pace with improvements made in the artisanal extraction component. There is a lack of infrastructure for marketing fish to inland zones. Marketing circuits for regional exports are deficient. The need for low cost fish as a source of protein for the domestic market is presently ignored.

Enhancements for further development of the FIS are large marine resources, potential large domestic demand and a well established export market, an acceptable level of industrial services and infrastructure and high government priority to the fisheries sector.

Expansion of the FIS will require assessment of deep sea stocks, rationalization of fishing rights near the coast in order to protect and promote artisanal fishing activities, fleet modernization and introduction of more efficient technology in catching and improving marketing systems addressing African markets.

5.11 Cuba[22]

Cuba, as a member of group 10, is one of the few countries in the study which engages in fishing in international waters outside of the exclusive economic zones. The Democratic People's Republic of Korea, also in group 10, is another. As its own waters are limited, Cuba also fishes within the EEZ's of other Caribbean and Central American countries under license or by agreement. Its distant water fleets operate in both the Atlantic and Pacific Oceans. A summary of Cuba's fisheries system and its intercomponent linkages is contained in the base diagram of figure 5.11.

Cuba's deep sea trawler fleet is composed of 30 stern trawlers supported by six freezer-transport vessels. A deep sea fleet of 19 tuna longliners and one purse seiner operates throughout the central Atlantic. A further 49 wooden vessels fish with hand lines, long lines, and trolling lines for reef fish, shark and large mackerel. Many of these fish within other EEZ's under bilateral agreements. They are often assisted by small catcher-boat launches.

The Cuban national waters fleet includes around 1,900 boats which operate in coastal waters for lobster, shrimp and fin fish. All the fleets are organized under 15 State Fishery Enterprises, most of which have their own independent units for vessel maintenance and fish handling.

Total fish production has stabilized at just under 200,000 tons, about 20 per cent of which goes to make fish meal and oil. The main fishing port is at Havana, which is equipped to serve large ocean fishing vessels. About 60 per cent of the catch is processed and there are some 16 processing and packaging plants, 6 canning factories and 12 refrigerated stores served by fleets of refrigerated and insulated trucks.

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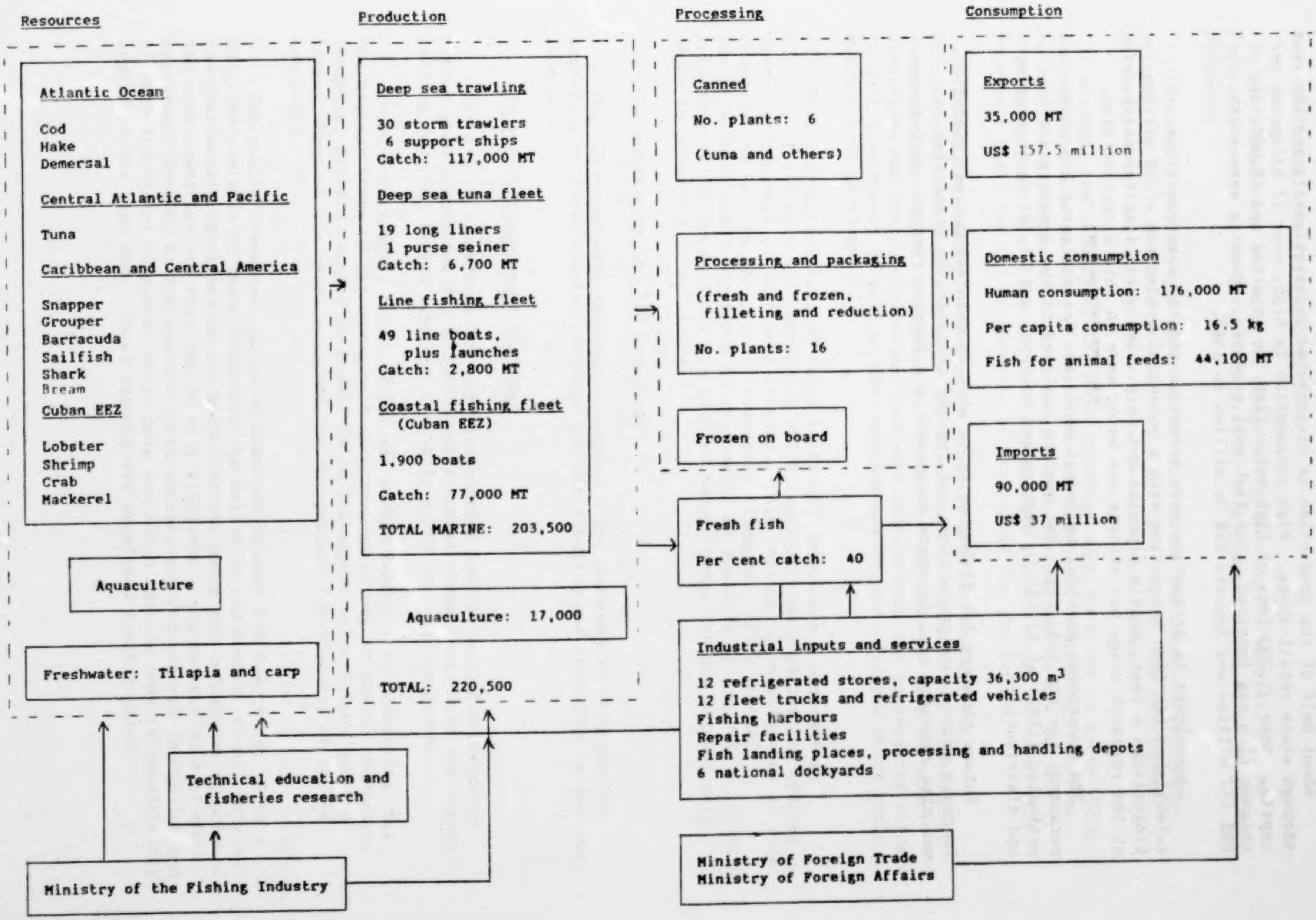
[22] These results are based on a mini case study and, hence, less detailed than those of the other countries in this chapter.

Figure 5.11. Base diagram FIS Cuba 1984


Resources
Production
Processing
Consumption
Atlantic Ocean
Cod
Hake
Demersal
Central Atlantic and Pacific
Tuna
Caribbean and Central America
Snapper
Grouper
Barracuda
Sailfish
Shark
Bream
Cuban EEZ
Lobster
Shrimp
Crab
Mackerel
Aquaculture
Freshwater: Tilapia and carp
Deep sea trawling
30 storm trawlers
6 support ships
Catch: 117,000 MT
Deep sea tuna fleet
19 long liners
1 purse seiner
Catch: 6,700 MT
Line fishing fleet
49 line boats,
plus launches
Catch: 2,800 MT
Coastal fishing fleet
(Cuban EEZ)
1,900 boats
Catch: 77,000 MT
TOTAL MARINE: 203,500
Aquaculture: 17,000
TOTAL: 220,500
Canned
No. plants: 6
(tuna and others)
Processing and packaging
(fresh and frozen, filleting and reduction)
No. plants: 16
Frozen on board
Fresh fish
Per cent catch: 40
Exports
35,000 MT
US$ 157.5 million
Domestic consumption
Human consumption: 176,000 MT
Per capita consumption: 16.5 kg
Fish for animal feeds: 44,100 MT
Imports
90,000 MT
US$ 37 million
Industrial inputs and services
12 refrigerated stores, capacity 36,300 m3
12 fleet trucks and refrigerated vehicles
Fishing harbours
Repair facilities
Fish landing places, processing and handling depots
6 national dockyards
Technical education and fisheries research
Ministry of the Fishing Industry
Ministry of Foreign Trade
Ministry of Foreign Affairs

About half of the production is distributed institutionally and the rest through state retail shops. Fish consumption is high, over 17 kilograms per capita. Over 35,000 tons of high value fish are exported and 48,000 tons of cheaper fish are imported, plus fish meal products. Exports were worth US$ 157 million and imports US$ 36 million in 1983.

Aquaculture is attracting more attention and the Government has established ten fish hatcheries with a potential production of 20 million fingerlings a year, mostly tipapias and carp. Sea water fish farming is still at the research stage but efforts are being made in this direction also.

The Government provides technical education for sea-going and shore personnel for the industry. The numbers employed in the industry are estimated (1982) at 13,482 in capture and culture, and 25,763 in processing and distribution.

Future strategy for fisheries is to seek to maintain marine production, increase aquaculture production, and improve or diversify processing to maximize resource use, increase employment and improve economic performance.

6. CHARACTERIZING FISHERIES SYSTEMS

In summarizing the major findings of the 64-country analysis of the fisheries sector as an integrated system, this chapter seeks to serve three purposes.

First, in providing a descriptive overview of the inter-relationships between the FIS components, enhancements and constraints, the development patterns identified in chapter 4 become better understandable.

Second, the summary of the major findings supplies a set of facts which enhances the understanding of the fisheries sector in developing countries. As such, this chapter will serve to stimulate discussions on how and why developing countries' FISs are in their present state. This, in turn, will provide a basis for the elaboration of strategies for the future.

Third, the summary of the major findings provides the setting, underpinning, and motivation for the selection and design of the development strategies and actions presented in chapter 7. In order to have an impact strategies and their required actions must address both the constraints which inhibit development as well as make maximum use of those factors which could enhance such development.

This chapter consists of three sections. Section 6.1 presents an analysis of the nine FIS components which resulted from applying the systems approach framework of MEPS to fisheries. This includes an examination of each component as well as their inter-component linkages. After a brief description of their frequency by continent, an analysis of how FIS enhancements and constraints are related among themselves and between each other is presented in section 6.2.

6.1 Characterizing the FIS components

The FIS components derived in chapter 3 are examined in this section according to their country rankings and distribution and according to how they interact.

Country FIS component ranking

Table 6.1 illustrates how the 64 countries rank by each FIS component. Rather than presenting the actual country scores themselves, only the highest ranking four and lowest four are ordinally given for each component.

Thus, for example, Chile, which was ranked number 1 in processing, has the highest share of its catch sold as processed of any of the 64 countries. Likewise, Algeria, ranked as number 64 in its export orientation, has the lowest share of its catch exported (in any product form) of any of the 64 countries.

Table 6.1, therefore, gives an overview on each FIS component. With a detailed analysis of these components to follow in the next sections, only a few preliminary observations are made. First, among the industrial components the same countries are observed to rank similarly - and on both ends of the spectrum. Second, Africa appears to be excessively represented in the low end of each industrial component while Asia and Latin America tend to consistently appear at the high end. These aspects are developed further below.

Table 6.1. Country rankings according to each FIS component[a][b]

Rank	Resource[c]	Extraction	Processing	Distribution & marketing[d]	Consumption
1	Guyana	Rep. Korea	Chile	Hong Kong	Maldives
2	Kiribati	Peru	Namibia	Rep. Korea	Solomon Isl.
3	Mauritania	Panama	Peru	Indonesia	Hong Kong
4	Somalia	Namibia	Ecuador	Chile	Malaysia
...	....	...	...	...	...
...	...	...	...	...	...
...	...	...	...	...	...
61	Zambia	Uganda	Algeria	Dem.Kampuchea	Sudan
62	Ghana	Sudan	Bangladesh	Maldives	Pakistan
63	Hong Kong	Malawi	Iraq	Madagascar	Iran
64	Chile	Madagascar	Kiribati	Kiribati	Somalia

Rank	Industrial inputs[e]	Government policy[f]	Ownership[g]	Export orientation[h]
1	Rep. Korea	Senegal	Dem.P.R.Korea	Peru
2	Chile	Indonesia	Cuba	Namibia
3	Hong Kong	Dem.P.R.Yemen	Dem.P.R.Yemen	Mauritania
4	Uruguay	Ecuador	Mozambique	Solomon Isl.
...	....	...	...	...
...	...	...	...	...
...	...	...	...	...
61	Kiribati	Venezuela	Nigeria	Kenya
62	Uganda	Gabon	Sudan	Egypt
63	Tanzania	Côte d'Ivoire	Zaire	Congo
64	Zambia	Iran	Bangladesh	Algeria

a/ Rank 1 denotes the highest value and rank 64 the lowest.

b/ See chapter 3 for a description of how each component was measured.

c/ Share of resource (MSY) unutilized.

d/ Sophistication of channels and methods used for distribution of outputs from the FIS.

e/ Extent to which intermediate and capital goods are domestically available for services and infrastructure.

f/ Government's view towards the sector, existence of incentives and favourable macro-economic policies.

g/ Proportion of government ownership and/or extent of government regulations and control.

h/ Share of output which is exported.

Distribution of FIS component country scores

The ranking of countries by characteristics and how they are distributed for each component is informative. Table 6.2 contains implications derived from these component distributions.

Correlations among FIS components

While previous sections on country ranks and distributions focus on the strength of each FIS component taken in isolation, the systems approach implies that all the components of a system are interrelated. By examining the correlations between FIS components it is possible to illustrate the linkages among components. Table 6.3 contains coefficients[23] describing the strength of these linkages.

Among the many tentative conclusions suggested by these correlations the following stand out.

1. The degreee of resource exploitation appears to be uncorrelated to the degree of artisanal extraction. This suggests that, contrary to some opinions, the artisanal sector, in general, is not responsible for overfishing.

2. The greater the share of the catch that is processed the more predominant is the country's export orientation and the lower is the share of artisanal extraction.

3. More sophisticated marketing and distribution systems are associated with greater utilization of the resource. Perhaps more interesting is the negative relationship between distribution and marketing and consumption. This suggests that low per capita consumption and, perhaps, demand may be a result of an inadequate distribution network. One cannot rule out the possibility that this occurs for the reverse reason, i.e., that lack of demand (if that is what low consumption indicates) destroys the incentive to develop distribution channels. This point is pursued in the next sections.

4. Better local availability of industrial inputs is highly related to a lower artisanal share of extraction, and to better distribution networks. Availability of industrial inputs is also related, although less so, to processing and export orientation suggesting that, perhaps, these latter two components are more heavily tied to foreign firms where imported inputs are more accessible. Finally, better local availability of industrial inputs seems to improve resource utilization.

23/ The coefficients vary between +1 and -1. A value of +1 means a perfect positive correlation, that is the two FIS components vary or move together in the same direction, while zero indicates no correlation and a value of -1 means a perfect negative correlation, that is the two FIS components vary or move always in the opposite direction. Values in between indicate a relative tendency toward one of these three cases.

Table 6.2. Distribution of countries by components

Component	Implication
Resource	Most countries either have highly unexploited or exploited MSYs; the percentage of sample countries in the 40-60% range is small.
Extraction	The majority of countries tend to have an above 50% share of fish catch contributed by artisanal sector.
Processing	Few of the countries had either less than 10% or greater than 90% commercial processing.
Distribution and marketing	The majority of countries had a barely adequate or insufficient distribution and marketing network.
Consumption	The majority of countries had sufficiently low levels to suggest that significant improvements are possible.
Industrial inputs	Countries tended to have either mediocre or grossly insufficient levels of locally available industrial inputs.
Government policy	The majority of FISs operate with some significant level of government involvement. Only a very small share of the countries had very heavy or very light government involvement.
Ownership	Developing country FISs tend to be operated by the private sector.
Export orientation	In very few countries are export markets important. This suggests that if production can be increased and processing facilities are available, scope exists for the FIS to contribute more to foreign exchange generation than is currently occurring.

Table 6.3. The relationship between FIS components as described by their pairwise correlations

	Resources	Extraction	Processing	Distribution & marketing	Consumption	Industrial inputs	Government policy	Ownership	Export orientation
Resources	1.00	0.05	-0.20	-0.40	0.06	-0.35	0.09	0.29	-0.11
Extraction		1.00	-0.54	-0.42	0.10	-0.69	-0.18	-0.06	-0.60
Processing			1.00	0.11	-0.13	0.33	0.16	0.02	0.48
Distribution and marketing				1.00	-0.20	0.74	0.05	-0.09	0.03
Consumption					1.00	-0.19	-0.25	-0.21	-0.39
Industrial inputs						1.00	0.04	-0.19	0.38
Government policy							1.00	0.31	0.31
Ownership								1.00	-0.02
Export orientation									1.00

5. Consumption per capita seems rather weakly related to most components. It is, however, quite naturally negatively linked to export market share. On the other hand, higher domestic consumption does not appear related to the utilization of the resource.

6. Government policy appears to be positively related to government ownership of FIS components though unrelated to resource utilization levels or abundance of local availability of industrial inputs. Government policy also seems to encourage a FIS's export orientation.

7. Government ownership seems to be unrelated to both export market importance for the sector as well as to the share of catch processed. The former is especially unexpected considering government policy is positively connected to the degree of export orientation. On the other hand, lower resource utilization is associated with higher levels of government ownership.

8. That a higher export orientation is associated with a higher share of catch processed is reasonable. In the former case, exportation requires some higher volume to be economic and to be exported it must first have been processed. This is supported by the negative extraction coefficient found indicating greater presence of commercial extraction in export-oriented FISs. The negative resource coefficient could indicate the association of higher resource utilization in export-oriented FISs. The association of a higher export orientation with greater local availability of industrial inputs may simply suggest that sectors which generate foreign exchange may have easier access to imported industrial inputs. (See point 4 above.)

These points suggest relationships requiring further examination which is done in the following sections.

6.2 Characterizing the FIS attributes

In this section the FIS attributes consisting of 27 constraints and 15 enhancements to development are examined first by noting their prevalence by continent and second by analyzing how they interrelate.

6.2.1 Frequency analysis by continent

The frequency of appearance of each constraint and enhancement by continent is presented in this section . In this way, general continental differences may be compared and contrasted.[24] This allows, at a glance, the identification by FIS component of each continent's major weaknesses and strengths.

Constraints

For Africa, the constraints within the industrial inputs component make this component the limiting factor to the continent's FIS development. The effects of this probably contribute to inadequate distribution infrastructure being such a predominant constraint. In only 27 per cent of the African countries is the availability of the resource a problem. In fact, the resource component in general is not currently a constraining FIS feature to the sector's development in Africa. The same applies to extraction and consumption levels. Finally, skilled manpower and energy are the areas most frequently constraining the sector's development.

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[24] It would have been preferred to conduct the analysis in terms of the country groups established in chapter 4. However, because of the small number of countries in most groups, this type of analysis may have led to erroneous conclusions. These limitations are overcome in the construction of tables 1 and 2 of the appendix to chapter 4 where an analysis is carried out at the country group level.

In the case of Asia, there is an across-the-board low level of constraining factors. The three exceptions to this are a lack of distribution infrastructure and a difficulty in serving interior markets, a general lack of extraction and processing infrastructure, and in availability of fuel/energy.

Latin America has even fewer constraints than Asia, none appear to be particularly pervasive at the continent level. The only minor exceptions to this are inadequate fisheries resources and inadequate distribution infrastructure.

The continent with by far the most constraints was Africa (167 or on average 6.4 per country), followed by Asia (97 or on average 4.2 per country), and then Latin America (36 or on average 3 per country). The major constraints by continent are summarized in table 6.4. The most common constraints for the sample as a whole were, in order of frequency, inadequate distribution infrastructure (47 per cent of the countries), scarce or expensive fuel/energy (45 per cent of the countries), lack of skilled manpower (44 per cent of the countries), lack of catch, processing infrastructure (38 per cent of the countries), lack of aquaculture inputs (28 per cent of the countries), inadequate repair and maintenance facilities (27 per cent of the countries).

Table 6.4. Most commonly observed FIS constraints by continent[a/] (in percentage)

AFRICA	ASIA	LATIN AMERICA
Lack of skilled manpower (69)	Lack of distribution infrastructure (48)	Lack of distribution infrastructure (42)
Lack of fuel and energy (65)	Lack of fuel and energy (39)	Inadequate resource (33)
Lack of processing infrastructure (50)	Lack of processing infrastructure (35)	Resource fluctuation (25)
Lack of distribution infrastrcture (50)	Lack of capital and inputs (26)	Lack of aquaculture inputs (25)
Lack of aquaculture inputs (46)	Lack of processing facilities (26)	Lack of demand (25)
Lack of spare parts (46)	Lack of skilled manpower (22)	

[a/] The number of countries per continent in the sample is 26 in Africa, 23 in Asia and 12 in Latin America.

Although not all constraints are equally debilitating, it might be interesting to note which countries that have the largest number of constraints. They were: Tanzania (13 constraints), Somalia (12 constraints), Democratic Kampuchea (12 constraints), Uganda (11 constraints), Congo (9 constraints), Madagascar (8 constraints), Colombia (8 constraints), Kiribati (7 constraints), Sierra Leone (7 constraints), Kenya (7 constraints) and Ghana (7 constraints). Those with the fewest constraints were Ecuador, Cuba, People's Republic of Korea, Oman, United Arab Emirates (1 constraint), and Argentina, Brazil, Chile and Republic of Korea (2 constraints).

Enhancements[25]

The strategies and actions in section 7.3 are in part designed to take advantage of the enhancement patterns described below.

For Africa, three enhancements stand out as being present in over 40 per cent of the continent's countries. These include the abundance of available resources, the meagre presence of any commercial operations,[26] and the favourable conditions for aquaculture development.

In the case of Asia, the picture is more favourable. Six enhancements are observed in more than 40 per cent of the continent's countries. The most predominant enhancement is that the government places a high priority on the sector. In general, all the government policy enhancements score highly for Asia. The other most predominant enhancements are the availability of spare resources, room for growth in the commercial sector, high government assistance to the sector, and a good potential for aquaculture.

Latin America shows a strong across-the-board existence of enhancements. In general, both the government priority enhancements and the industrial input enhancements are frequently observed. In addition, a good joint-venture climate and suitable aquaculture potential are two other enhancements observed in more than 45 per cent of the continent's countries.

The most common enhancements in order of frequency were high government priority (37 countries), good aquaculture potential (32 countries), good resource potential (30 countries), use of joint ventures, positive attitude to foreign investment, low share of commercial catch processed, and large share of final product remains unprocessed (27 countries each). Twenty countries were classed as energy rich. Although 37 countries were listed as allocating high priority to their fishery sectors, only 17 states, less than half the number, actually provided a high degree of assistance to the industry.

Though not all enhancements are equally beneficial, the countries with the most enhancements were Indonesia (12 enhancements), Uruguay and India (9 enhancements), Chile, Oman, Tunisia, Mexico and Peru (8 enhancements) and

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[25] Though Oceania (Fiji, Kiribati, Solomon Islands) with just three countries was not presented here, it is still interesting to note that its most predominant development enhancements fall under the favourable government attitude toward the FIS. This is complemented by a favourable joint venture climate and a low saturation of domestic markets. Finally, this low domestic market share is serviced by a low level of processed fish leaving room for further expansion in processing.

[26] This is an enhancement in the sense that there is much scope to increase the system's industrial components.

United Arab Emirates, Bangladesh and Cuba (7 enhancements). Those with the least number of enhancements were Mali and Zambia (1 enhancement each), and Gabon, Nigeria, area of Hong Kong, Iran, Republic of Korea, Saudi Arabia and Turkey (2 enhancements each). Since enhancements are defined with respect to further development, their number does not indicate the level of a country's development.

Latin America had the highest average number of enhancements, 6.3 per country, Asia 4.9 per country, and Africa 3.9 per country. The major enhancements by continent are summarized in table 6.5.

6.2.2 The relationship among FIS attributes

This section summarizes the major results of examining the associations among the various constraints, the various enhancements, and between the constraints and the enhancements.[27] An understanding of these relationships is useful for two reasons. First, in order to formulate FIS policies, their likely consequences should be taken into account. Second, because a FIS is an integrated system, modifications or exogenous influences to one part of the system may have an impact on other parts of the system. These hidden relationships also should be taken into account when remedial actions are considered. The associations presented in this section attempt to show these system linkages.

Table 6.5. Most commonly observed enhancements to FIS development by continent[a] (in percentage)

AFRICA	ASIA	LATIN AMERICA
Aquaculture potential (54)	High government priority (70)	Attracting foreign investment (75)
Large artisanal share (54)	Large fresh fish share (52)	Aquaculture potential (66)
Good resource (50)	Aquaculture potential (44)	High government priority (66)
Use of joint ventures (38)	High level of assistance (44)	Good extraction inputs (66)
High government priority (38)	Large artisanal share (44)	Use of joint ventures (42)
Large fresh fish share (38)	Good resource (44)	

a/ The number of countries per continent is 26 in Africa, 23 in Asia, and 12 in Latin America.

27/ This work is based on two techniques: contingency table analysis and correlation analysis. The complete technical procedure is presented in Volume II. See also e.g. Kendall, M. and Stuart, A. (1979), The Advanced Theory of Statistics, Volume 2, New York: Macmillan Pubishing Company, Inc. (especially pp. 580-590).

The main findings of this 64-country analysis are presented below according to the FIS components they most affect. It should be kept in mind that they are based on a series of statistical analyses of data and expert opinion on 64 countries covering 63 different aspects of FIS in developing countries. This has two implications. First, each relationship represents a specific, underlying tendency across existing FISs and must be understood prior to prescribing strategies for the future. Second, being based on an analysis of 64 countries, this study provides a rare opportunity to go beyond the detailed but country-specific - and therefore limited - knowledge and experience of individual FIS experts.

Resource

- Government assistance frequently is accompanied by government concern about good resource management since an economic return on assistance requires good management. Such government support for good resource management may, in fact, be viewed as indirect sector assistance which makes the observed association all the more understandable.

- The predominant factors impeding a higher utilization rate of resource are lack of credit, insufficiently trained manpower, and inadequate repair and maintenance facilities. The latter constraint may have an adverse effect on the fleet and, hence, the system's extraction potential.

- Good storage and handling is surprisingly (positively) associated with an inadequate resource. This suggests two things. First, storage and handling is importantly linked to all nine system components. As such, when it is abundant the system tends to raise the utilization of its resource. This association reveals that, at times, this high utilization leads to a resource shortage in the system. Second, with an inadequate (relative to system capacity or final demand) resource, greater efficiency of the scarce resource is encouraged. Thus, though good storage and handling is an effective way to improve efficiency, extreme care must be taken so as not to over-exploit the resource itself.

- A good aquaculture potential will demand aquaculture inputs and when the potential remains under-utilized, it suggests that such inputs are still missing.

- One important factor which prevents countries with aquaculture potential to develop it is the lack of ice making capacity. This is probably most applicable for aquaculture projects geared to export markets.

Extraction

- Because of the observed complementary of labour and capital in the extraction process, it is found that extraction requires the simultaneous availability of good fleet operator skills and capital and intermediate extraction inputs in order to properly develop. Either one by itself is insufficient.

- High government priority given to fisheries indirectly encourages investments in manpower training.

- The existence of joint ventures tends to promote the improvement of operator skills at the extraction stage as one of the multiplier effects of this form of technology transfer.

- An insufficient resource limits interest by both government and industry leaving rudimentary artisanal fishing to predominate.

- Lack of capital restricts investments in more sophisticated fishing equipment. Hence, adequate credit policies are needed when the level of technology of the artisanal extraction operation should be raised.

- The lack of ice plants affects the quality of the extraction operation. Ice is an important input for all levels of fishing operations and its availability should be guaranteed to improve fishing operations.

- Lack of spare parts can cause other severe system constraints by crippling catch infrastructure.

- Undercapitalization of the sector constrains a FIS most through its effects on catch and processing infrastructure.

- The availability of ice - a critical ingredient for larger scale extraction - is seen to create a demand for skilled fleet operatives.

Processing

- Joint ventures are made for industrial fishing and processing activities and as such tend to ensure that a large share of the commercial catch is processed.

- A large share of the commercial catch being processed generally requires exporting. Thus countries with a large share of the commercial catch being processed also tend to have a higher share of their product exported.

- An inadequate resource base often discourages the necessary investments to increase the degree of processing.

- Lack of ice plants and processing facilities are associated with general underdevelopment of the sector. However, ice plants can appear in the system before processing plants. In general, the existence of sufficient sources of ice are required if processing on any scale is to be carried out.

- Lack of processing facilities may be due to low profitability of investment due to high energy costs.

- Insufficient credit not only inhibits the processing component's ability to expand, it also encourages cutbacks in quality as equipment cannot be maintained or replaced. Thus, insufficient credit can directly reflect low quality standards in the final product.

- Lack of spare parts can cause other severe system constraints by crippling processing infrastructure.

- Undercapitalization of the sector constrains a FIS most through its effects on catch and processing infrastructure.

- A poor distribution infrastructure hinders or prevents the catch from reaching processing plants or potentially viable locations for them. As a result, a lower share of the catch is processed.

- A low share of the commercial catch processed is a direct result of insufficient processing infrastructure and a lack of available ice. Due to the ubiquitousness of poor distribution infrastructure, the need for ice becomes that much greater. Thus, the lack of ice capacity may be considered a root cause of the low share of the commercial catch processed.

- Good processing inputs compensate for inefficient or inappropriate marketing systems. Only through more highly processed product forms can the ill-effects of slow or inefficient distribution be compensated and a given demand for fish be met.

Distribution and marketing

- The lack of associations (and, hence, linkages) among the enhancements related to distribution and marketing underscores the severity of the constraints affecting this component.

- An inefficient or inappropriate marketing system may, in fact, be the real cause for processing standards to appear poor. The processing done may simply be insufficient to ensure that the product passes the marketing system to the final consumer in a satisfactory condition. Systems with these constraints are often unbalanced with respect to the processing product forms given the available marketing system.

- Adequate distribution infrastructure demands large capital investments and inputs. Their adequate availability is one prerequisite for securing adequate distribution infrastructure, especially if fresh fish is being distributed. This is true for both the improvement or expansion of infrastructure and its upkeep at present levels.

- The lack of ice plants showed a strong association with systems constrained by general under-development.

- Cold stores demand high consumption and its lack therefore reduces the availability of the former.

Consumption

- Because of the constraints affecting distribution and marketing, the linkages between supply and demand enhancements were found to be tenuous.

- An insufficient resource forces the development of other protein sources and the demand for fish is low, since importation is frequently not desirable.

- In the presence of abundant or medium size resources there is still a low potential for growth if lack of domestic demand and lack of exports are associated. This indicates a tendency for FISs constrained by local demand to also be constrained by foreign demand.

Industrial inputs

- To motivate investments in manpower skills it is necessary to guarantee economic returns which require resource management. Such an association is, in fact, observed.

- Poor resource management presumably has a negative effect on the aquaculture resource as well. This discourages investment in aquaculture production and reduces the demand for aquaculture industrial inputs to be made locally available.

- Rudimentary artisanal harvesting places such minimal demands on the industrial components of a FIS that the incentive to supply inputs in general and aquaculture inputs in particular is very low.

- Under-capitalization especially affects the processing component; the same was not found with regard to extraction.

- There is a tendency in distribution-constrained FISs to compensate for this by strengthening the rest of the system (notably processing) through the availability of better maintenance and repair.

- On the one hand, factors contributing to a lack of capital and intermediate good inputs (e.g., lack of foreign exchange) may also contribute to a lack of spare parts. On the other hand, the lack of access to new plant and equipment increases the need for repair and spare parts to maintain current installed capacity. Thus a weakness in one subcomponent can put extra stress on other subcomponents.

- Lack of cold stores and ice plants are found to be strongly affected by the lack of capital and intermediate inputs.

- Lack of capital discourages investment in manpower training. To a lesser extent some capital investments require skilled labour to be effective and, therefore, the scarcity of skilled labour may reduce the demand for investment.

- War or instability tend either to redirect and absorb scarce capital and intermediate good inputs and spare parts or to discourage expenditure for them. In addition, the former may absorb foreign exchange which would otherwise be available to make purchases of the latter.

- Variability of the resource does not promote the training of skilled manpower, since the investment return is uncertain.

- Scarcity or high cost of fuel tends to reduce the return on capital investment thus discouraging expenditure. In addition, scarce foreign exchange may explain the unavailability of these inputs.

- To overcome the constraint of inadequate repair and maintenance facilities, the problem of the lack of spare parts must be dealt with.

- Lack of catch and processing infrastructure tends to discourage investments in manpower training.

- Investment in improving repair and maintenance facilities is seen to have a direct impact on increasing the availability of operational cold stores.

- To compensate for under-capitalization, the establishment of repair and maintenance facilities is promoted to protect available capacity.

- Repair and maintenance facilities do not appear as a constraint when skilled manpower is available.

- The lack of ice-making capacity and cold storage is probably yet another example of how systems with basic deficiencies tend to discourage investments in manpower.

- Due to factor input substitution possibilities in production, under-capitalized FISs tend to compensate by promoting the training of labour. Conversely, to the extent labour and capital are complementary, an insufficiency of one reduces the demand for the other.

- A sufficient and constant availability of capital and intermediate good inputs provides an incentive for manpower-enhancing investment since a return to such investment becomes more likely.

- An over-capitalized FIS, due to labour/capital complementarity in production makes it more likely that labour is also well trained.

- The relationship between good storage and handling and an over-capitalized system underscores the capital-intensive nature of storage and handling.

- An abundance of extraction inputs and infrastructure, even when in excess of current system requirements, encourages training. Similarly, a solid skilled manpower base may lead to the formation of extraction infrastructure.

- High government priority to the FIS encourages firms and individuals to invest in manpower skills as well as direct government participation in manpower training programmes.

- Generous government assistance to fisheries usually promotes capital and intermediate inputs investments in the sector.

- Foreign direct investment also promotes the formation of skilled manpower. To a lesser extent foreign investment favours systems with skilled manpower.

- Out of all the industrial inputs, the availability of aquaculture inputs was most associated with joint ventures. Although these may be attracted to other sectors, it is more likely that joint ventures are the principal way countries can secure such inputs.

- Joint ventures promote capitalization of the fisheries sector.

Government policy

- A government policy to promote the development of FIS cannot only give high priority to fisheries but should also give generous assistance to it. (Although this association was strong, the fact that it was not stronger indicates in many countries inconsistencies between policy and action).

- Government policy tends to ignore FISs where rudimentary artisanal harvesting predominates.

- A generally underdeveloped sector frequently does not have the collateral or influence to exert pressure for obtaining credit.

- Good processing inputs in the absence of sufficient credit still hinder the correct operation of the system.

- In the absence of adequate resources no priority is assigned to fisheries by the country government.

- High government priority will naturally be attracted to the sector when there has been a strong fisheries tradition. The existence of skilled manpower suggests that there may be such a tradition.

- Generous government assistance to fisheries is given when the system has attained a certain degree of development.

Ownership

- The successful implementation of joint ventures is more likely in countries with large good resources.

- Good management could be promoted through the joint-venture mechanisms or good resource management at the local level is required for attracting joint ventures. Foreign investors, to be guaranteed a return, require the secure source of supply which good resource management promotes. This may be contrasted with the selling of fishing rights where the foreign owner may be less concerned about the longevity of the resource.

- Generous assistance to fisheries given by the government makes it easier to attract joint ventures.

- The association between foreign direct investment and adequate catch and processing facilities can be traced to three causes: first, foreign direct investment (FDI) tends to bring with it the capital and technology to improve the infrastructure; second, governments more easily attract FDI when an adequate infrastructure is available. Third, governments are attracted to FDI as a means to better exploit their investment in infrastructure.

Export orientation

- Successful joint ventures often are created to tap export markets. This is because the foreign partner is assured of foreign exchange and the host country is able to increase its capture of value added since exports markets require processed products.
- There is a minimum level of development of the FIS required before addressing export markets.
- Good processing inputs are useless unless a demand exists. Therefore, to understand a lack of domestic demand in systems with good processing inputs, it must be assumed that foreign demand (exports) is a substitute for domestic demand. Exportation requires processing and this encourages the supply of processing inputs. Over-capitalization can occur if demand (domestic or foreign) is not sufficiently studied before investing.
- A high export share is promoted by lack of internal demand.
- A fluctuating resource is most serious as a constraint when the resource is highly exploited. Sectors with high export shares are those which most often utilize more fully the available resource. Thus, a fluctuating resource is most often a constraining factor in sectors with a high export share.
- The availability of adequate, inexpensive fuel reduces distribution costs and the cost of ice making. This allows a larger quantity of fish to be available at a lower cost. This tends to induce higher domestic demand.

The strongest association among the enhancements would seem to be between good operator skills and good storage and handling, between high goverment priority to the fisheries sector and generous government assistance to the sector, and between large share of catch consumed as fresh fish and large artisanal share of processing.

Among the constraints, the strongest associations would seem to be between rudimentary artisanal fishing and lack of ice plants, between lack of capital inputs and lack of ice plants, between lack of capital inputs and general underdevelopment, between lack of aquaculture inputs and general underdevelopment, and between lack of repair and maintenance and lack of skilled manpower.

Between enhancements and constraints, the strongest positive associations were between good storage and handling and over-capitalized FIS, between a large artisanal share and lack of ice plants, between a high export share and lack of domestic demand, and between good aquaculture potential and lack of aquaculture inputs.

While a FIS is much too complex for a simple comparison the associations found can contribute to the formation of theories about how the system components are inter-related. This, in turn, should lead to the formulation of better development strategies and the present study should be considered in this light.

7. FIS STRATEGIES AND SUGGESTED DEVELOPMENT ACTIONS

The goal of this chapter is to outline possible development strategies and to suggest appropriate actions for implementing them. As the strategies and suggested actions will be pattern-specific and pertain to a given country only to the degree the country fits the pattern, they will have to be modified when applied to the individual countries. Nevertheless, they should give a valid basis and a general direction also for country strategies.

Since each pattern represents a real development situation, the presentation of the strategies provides a framework for discussion of sectoral development across countries.

The strategies and related actions evolve, as a result of the analysis of the current systems as presented in chapter 6, i.e.:

- an analysis of nine FIS components (including the country case studies described in chapter 5)
- taking advantage of each development pattern's strong points (enhancing attributes)
- addressing current system bottlenecks and constraints, analyzing how they materialize, and how to alleviate them.

A four-step approach is taken in this chapter. First, the development objectives both with respect to fisheries and to general economic development are identified. Second, based on the assessment of the present state of the FIS and these objectives, strategies are designed. Third, required actions are formulated which specifically address bottlenecks and constraints to development while taking advantage of those positive factors that could enhance such actions. Finally, these actions are translated into technical assistance and investment requirements.

7.1 General comments

In discussing FIS policies and strategies some of the principles and guidelines to be considered by governments when assessing and programming the development of FIS, were presented to the FAO World Congress on Fisheries Management and Development.

- The fisheries are viewed within a system in which different industrial consumption and policy components interact.

- The setting of objectives should take an integrated approach and should be based on an assessment of the fishery resources available, existing technology, markets to be served, social and economic conditions, the potential impact of other economic activities and other relevant factors, including foreign operations, where applicable.

- Fishery development plans should be an integral part of national economic development and food security plans and be in accord with social and nutritional goals and established priorities.

- Development planning should be comprehensive and should take account of all aspects of the fisheries sector, not only harvesting, processing, marketing, servicing and material supply, but also the development of the infrastructure, technology and human resources to enable developing countries to better exploit their fishery resources, to increase the value added to the economy and to improve employment opportunities.

The above definitions and concepts agree entirely with the systematic approach applied throughout the present study while identifying patterns of development or analyzing case studies.

All national plans and projects for fisheries development will reflect to some degree the global fisheries situation. Future production increases are possible but will not come about easily. There will have to be greater diversification on both the extraction and post harvest sides of the industry. Effective increases in supply will also come from waste reduction and by-catch utilization. This in turn will demand greater efforts in the fields of hygiene, curing, processing and quality control. There will need to be more careful consideration of social and economic factors and constraints such as the need for employment and the cost of energy, fuel and imported machinery. Processing of export fish will take place more and more in the producing country, especially for those processes which may be labour-intensive. International co-operation in the form of joint ventures or licensed fishing will continue but with more attention being paid to the terms and conditions of such arrangements. Countries with large marine extended economic zones will also need to work in close co-operation and consultation with other countries in their region. A serious and rational approach to conservation in the long-term and to development in its broader aspects will be a feature of national fishery plans.

Most of this is clearly reflected in the plans of action devised by the case study countries. Over-fishing, inappropriate technology, over-specialization, neglect of basic infrastructure and insufficient consideration of social elements have left their mark on the fisheries sectors of both developed and developing countries. Fish stocks have been seriously reduced, vessels have rusted away and whole industries have collapsed due to changes in foreign markets or the environment. Fish has rotted or been fed to animals while communities close by have been malnourished, and whole villages have lost their livelihoods through fishing fleets from distant ports or countries.

7.2 Group-specific development strategies and actions

Constraints characteristic of each group will pose special problems and impede the successful application of the strategy, unless specific remedial inputs are provided which constitute the suggested action plan for each group. These actions have been suggested on the basis of the group characteristics and potential. The use of examples of actions taken by specific states within the group is thought to be useful, first for the countries in the same group and second for countries in other groups with similar problems and constraints, since specific technical or organizational methods and systems can usually be adapted for use in countries with different patterns of development.

The strategies and the suggested actions are presented by group in tables 7.1 to 7.10. In those tables the strategy components appear in column 1, the most salient problems identified as impediments to their successful application are shown in column 2 together with the relevant constraints and enhancements. Suggested remedial inputs to overcome the constraints and problems are listed in column 5 and ongoing applications are illustrated in the last column.

Group 1: Least favoured countries (Bangladesh, Cameroon, Ghana, Kenya, Madagascar, Malawi, Mali, Nigeria, Sudan, Tanzania, Turkey, Uganda, Zaire, Zambia)

Strategy. Group 1, the largest and most African of the groups is also the one which faces the most problems. Limited resources, poor infrastructure, inadequate distribution and low income markets can be found in most of the 14 states. Four of the states are landlocked and all have large freshwater resources. There are, however, communication difficulties, compounded in several cases by the effects of drought.

Large domestic markets exist and there is potential for exports, both of cured fish to neighbouring states, and of frozen shrimp to Europe. Furthermore, there is considerable scope for aquaculture, particularly of tilapia species which are not expensive to rear.

Considering the potential and present constraints affecting the FIS of this group it seems appropriate that the increase of production for the domestic market would be best achieved by improving the efficiency of the large artisanal sector (a total of 1.5 million fishermen) and developing the large potential in aquaculture. This will require improvements in training, credit and rural infrastructure including marketing and distribution. The increased production of fish would mainly be for the internal market. This will require the improvement and extension of distribution infrastructure, the improvement of the system's efficiency (quality and yield of the fresh and cured fish), the raising of skills and productivity of artisanal fishermen, the establishment and expansion of fisheries infrastructure and the integration of small-scale enterprises with rural development programmes.

Of the group, only Bangladesh and Turkey are fish exporters of any note, and Nigeria is the largest fish importer in Africa. None of their domestic markets are adequately supplied, particularly in the towns and villages distant from the coast, rivers or lakes.

Capital-intensive industrial activities emphasizing industrial fishing and fishing for exports would seem appropriate only in countries with sufficient financial and energy resources. Caution should be exercised in adopting this strategy in view of the relatively limited marine resources and the possibility of endangering employment effects.

Suggested actions. Three countries in this group have the financial and energy resources for a capital-intensive type of fishery (Nigeria, Turkey and Zaire), however, the fisheries need modern technical skills. For these countries investments in fisheries basic infrastructure would be necessary as well as investments in aquaculture and training at all levels. Nigeria is presently using development bank loans for this purpose.

The artisanal fisheries of group 1 could benefit from technical assistance in basic areas like boatbuilding, mechanization and fish curing. Simple facilities around which fisheries activities might develop should be established as envisaged in the community fishery centre concept. It is imprudent to introduce refined co-operative structures to a primitive fishery or to bring in complex machinery. But small fishermen's associations and co-operatives might develop within local village structures if given the basic facilities and some encouragement. This is already happening in many of the FAO and bilateral aid projects in these countries.

The technology introduced should be simple and low cost, an example could be to introduce or improve sail-power on local boats. Some African lake fisheries still do not utilize wind energy, particularly on the man-made lakes like Kariba. This is an area where fishermen of Asia could provide technical assistance to those of Africa.

The technologies and equipment required are not exclusively fisheries ones. They relate also to rural development. Clean water is an essential for community health as well as for fish quality and general infrastructure and aquaculture development. This does not have to be an expensive innovation as Rotany and ITG projects have demonstrated, with the Cansdale SWS and other low cost systems.[28/] Without an acceptable village level technology to begin with, many artisanal fisheries will never be able to attain economic progress.

Fish quality and distribution could be greatly improved by the use of simple solar driers and fly-screened storage boxes for cured fish. Their cost is low and could be recouped in a short time in savings on spoilage which is very high on fly and beetle infestation. Much of the fish curing in Africa is undertaken by women who also control the fish trade in certain states.[29/] Community or fishery extension services working with these groups could encourage such innovations and improvements. The services might also arrange supply of materials perhaps under some simple credit or deferred payment arrangement.

Training of small-scale boat builders, marine mechanics and fisheries technicians should continue to receive priority as it has in some of the countries of group 1. The training of fish farmers needs to be intensified and aquaculture be demonstrated to be profitable in pilot projects in different areas. Schools could participate in both fish farming and fish curing exercises, incorporating technical fisheries training with nutritional programmes.

The introduction of energy conservation systems, the standardization of imported equipment, the rationalization of import regulations and the establishment of maintenance procedures and facilities are important supporting actions for the implementation of the development strategy in this group.

The examples given of ongoing actions in African countries given in table 7.1 should encourage the introduction of similar measures in other countries of this group.

28/ FAO, UNDP/S. China Sea Report.

29/ Case studies in the role of women in the Fisheries Industries are at present being carried out by UNIDO for countries in Africa, Asia and Latin America.

Table 7.1. Group 1: The least favoured countries
(Bangladesh, Cameroon, Ghana, Kenya, Madagascar, Malawi, Mali, Nigeria, Sudan, Tanzania, Turkey, Uganda, Zaire, Zambia)

Strategies	Special problems	Relevant		Appropriate actions	Examples of ongoing actions
		Constraint	Enhancement		
Increase production of fish for the domestic market.	Lack of infrastructure and facilities. Inadequate capital inputs. Fishing vessels unable to exploit offshore waters.	10	11 12	Investment in harbours cold stores, fish processing plants, boatyards and marine engineering workshops.	Development bank loans for fishery harbours and infrastructure. Use of joint ventures to provide offshore fishing fleets and fish processing plants. Foreign investment in fish capture and processing companies. (Nigeria) Training of local personnel in foreign ships and factories. (Ghana)
Improve quality of fresh and cured fish and reduce waste from spoilage.	Lack of repair and maintenance facilities and services, to support industrial inputs.	14 23	6 3	Training of local technicians and mechanics.	
Extend distribution through better communications, transport and markets.	Distance of local fish markets from landing places. Inadequate roads, transports, storage.	13 26 7	6	Improvements to roads. Development of fish transport systems. Construction of hygienic fish markets with clean water supplies and ice.	Technical assistance from FAO. Financial aid for fish culture from UNDP and bilateral aid. (Bangladesh, Cameroon)
Introduce and develop aquaculture for both food fish and export species.	Lack of aquaculture inputs.	12	14	Investments in fish ponds and hatcheries and provision of extension services to fish farmers.	Rural development programmes with fisheries components. Technical assistance and advisory services from FAO Infopeche. (Nigeria)
Raise the skills and productivity of artisanal fishermen and fish curers.	Shortage of skilled personnel for offshore fisheries and for processing plants.	24		Technical training of personnel at three levels, basic, intermediate and advanced.	Use of field training centres, technical schools, apprenticeship schemes and fellowship programmes. (Zambia)
Exploit offshore fisheries for tuna, shrimp and small pelagics, particularly for export trade.	Fuel and energy costs and availability. High fuel consumption offshore fisheries. High energy consumption fish processing plants. Quality.	17 26	6	Introduction of fuel and energy conservation systems. Development of less energy expensive vessels and plants. Use of alternative fuels and energy sources where feasible. Personnel training in quality control and hygiene.	Introduction of smaller, less powerful offshore vessels for tuna and sardine. Insulation of fish holds and ice stores. Heat recovery in fish plants. Sail power for small boats, solar heating in fish meal and fish drying plants. (Various) Export quality control programme UNDP. (Bangladesh)
Establish and expand fisheries infrastructure, harbours, cold stores, ice plants, slipways, markets and retail depots.	Lack of spare parts for imported machineries.	11		Limitation and standardization of imported machineries, liberalization of import regulations. Establishing maintenance schedules and servicing routines before equipment is purchased.	Consultation and co-operation between bureaucracies in technical, purchasing and customs departments. Simplifying procedures. Insistence on training for personnel and service agreements with manufacturers before purchases are made. (Various)
Integrate small scale fisheries plans with rural development programmes.					

Group 2: Largely state controlled fisheries (Angola, Burma, China, Democratic Kampuchea, Mexico, Morocco, Mozambique, Viet Nam, Democratic Republic Yemen)

Strategy. Group 2 countries have fairly well developed fisheries with a considerable degree of government involvement. They are also favoured with significant potential for expansion, both for export and domestic markets. Mexico's case study and development plans reflect a healthy mix of industrial and artisanal fisheries, and aquaculture. Joint venture fishing enterprises are used by at least 6 of the 9 states, to promote offshore or export related fisheries. The level of skills in group 2 is generally low with few exceptions. The technology used is low on average and preference is given to labour intensive rather than capital-intensive systems. Co-operatives are a feature of the artisanal fisheries in this group, though individual structures vary greatly from country to country.

Shrimp and fish meal are the main exports of group 2 fisheries. Industrial or reduction fisheries exist in four of the states - Angola, Mexico, Morocco and Democratic Yemen. They all have large domestic populations to supply and there is a considerable potential for expansion of this market.

Three of the countries, Angola, Democratic Kampuchea, Viet Nam, are presently rebuilding their domestic fleet and national fisheries structures while Mozambique has started to develop its industry. The fisheries of China and Burma have developed well with little outside influence while those of Mexico and Morocco have had co-operation with developed country fisheries. Given the large resource potential, the large artisanal sector and some export tradition, a mixed industrial and artisanal development strategy seems appropriate to attain objectives such as increased food availability, expansion of trade and employment and promotion of industrial development.

The increased production of fish should be for both the internal and external markets and should promote fresh water fishing, as well as in- and offshore fishing operations. Strategy components are increased processing of fish for domestic and export markets, product development from underutilized species and the improvement of quality for export products. The capital goods and the technology sectors should be developed in order to reduce dependency on imported vessels, machinery and equipment and to improve product quality. Supporting strategies would be the improvement of distribution, the promotion of internal consumption and the expansion of the role of the artisanal sector through co-operatives or other types of associations.

Suggested actions. The group pattern is to work towards self-reliance in fisheries while utilizing foreign co-operation to facilitate present expansion (see table 7.2). Mozambique and Angola are the most dependent on foreign assistance and they are making strenuous efforts to develop their own fishery skills and infrastructures.

Special problems relate to low levels of technology in vessels and post-harvest industries, lack of skilled personnel, insufficient transportation infrastructure, inadequate capital inputs and inadequate number and types of offshore vessels.

Table 7.2. Group 2: Largely state controlled fisheries
(Angola, Burma, China, Democratic Kampuchea, Mexico, Morocco, Mozambique, Viet Nam, Democratic Yemen)

Strategies	Special problems	Relevant Cons-traint	Relevant Enhan cement	Appropriate actions	Examples of ongoing actions
Develop offshore fishing Increase processing for both domestic and export trade.	General low level of technology in use on vessels and in post-harvest industries.	11 14 24	12	Technical assistance from agencies, bilateral aids, and/or joint venture partners. Investment in upgraded technologies.	Development of fish meal and fish canning industries with foreign partners. (Angola) Expansion of shrimp fishing fleet and export trade with joint venture companies. (China) Training of deep sea personnel and support industry officers in U.N. progammes. (Burma)
Support and expand role of artisanal fishermen.	Enormous distance or difficult terrain between fishing ports and population centres.	8,9	14	Fish curing or processing methods to produce longer shelf life for fish products. Improved transport containers for fish.	Encouragement and assistance to fish curers, traders and co-operatives to upgrade products and market further afield. Increasing demand in inland towns through consumer education and institutional feeding programmes (Mexico)
Develop new products from underutilized species.	Lack of manpower skills in vessel operation, fish processing, management and maintenance.	24 13	12	Use of U.N. and bilateral fellowship programmes. Training of personnel on foreign vessels or J.V. plants.	Establishment of training centres, technical colleges and applied research centres for fisheries, with bilateral or U.N. assistance. (Democratic Yemen, Mozambique, Mexico)
Reduce dependence on imported vessels, machinery and equipment	Poor or varying processing standards and subsequent loss or wastage.	7			
Improve quality to raise value, particularly for export products.	Inadequate capital inputs or infrastructure.	11 13 24	12	Investment in clean water systems, hygienic premises and speedier handling systems. Vigorous and comprehensive training and hygienic practices and quality control.	Basic infrastructure and quality control programmes for fish marketing. (Various) Quality control service for shrimp export industry, with FAO support. (Mozambique) Large international fishery development plan, infrastructure and facilities. (Mexico) International credit to support fleet and plant expansion. (Various)
Promote distribution of fish and consumption by local population.	Fishing fleet largely artisanal, inadequate number and type of offshore vessels.	13 7	6	Government funding for capital investments in fisheries. Use of development bank loan funds. Design and construction of locally appropriate new vessel types.	Diversification of offshore fleet and development new generation or more economical tuna seiners. (Mexico)
Maintain or expand employment in the fishery sector.	Some major fish stocks offshore or in deep waters.		9 1	Use of joint venture fleets in the interim period.	Granting of fishing licenses to foreign fleets. Use of joint venture partners in capture and processing of shrimp. (Mozambique)

Energy costs are high for the offshore fisheries of this group and a reappraisal of offshore fishing technology is necessary to minimize fuel consumption or to maximize fish production vis-à-vis the amount of fuel used. Mexico is currently undertaking these actions and one result will probably be a change in tuna vessel design, smaller, lower-powered ships replacing the former huge and expensive type seiners. Utilization of the by-catches from shrimp trawling will also improve the energy performance of that fleet. As the artisanal fisheries are less energy intensive and more labour intensive, they are receiving more attention in national fishery plans. Mexico is encouraging more harvesting by this sector, both for domestic supply and export processing plants.

Group 2 has enormous manufacturing and processing potential. The development of local shipyards and support industries is, therefore, a logical feature of fishery plans and is illustrated in Mexico's case study. This should be expanded through joint ventures and licence agreements to local production of marine engines, deck equipment and processing machinery wherever possible. For the smaller or poorer countries of group 2, this is not a present possibility and they will have to concentrate for some time on building up their basic infrastructure and skills.

Group 3: Low priority fisheries (Brazil, Colombia, Gabon, Islamic Republic of Iran, Iraq, Saudi Arabia, Sierra Leone, Venezuela)

Strategy. With the industrial base found in the countries of this group, there is good potential for increases in both the domestic and export supplies of fish but these require some encouragement by the governments concerned. There is also a large aquaculture potential, especially in Brazil, Venezuela and Colombia. These countries are also in a position to develop support industries in boat building and fish processing.

The fisheries sector could also contribute significantly to employment and this must be a factor for those countries with large artisanal sectors. Brazil, Sierra Leone, Gabon, Colombia and Venezuela have relatively unskilled coastal or rural populations who could benefit in this respect.

The capital-intensive industrial fishery approach may also be attractive for group 3 countries which have the financial and energy resources to support it. Brazil, Colombia and Sierra Leone may be exceptions here as they have sufficient labour, resources which is not the case in Saudi Arabia, Venezuela, Iran and Iraq.

For this group options for labour- or capital-intensive or a combination of both exist, keeping in mind the limitations of the resource. This would imply the need for appropriate government management policies.

The strategy of group 3 should promote objectives related to food production and employment. The artisanal sector should be promoted without disregard for the industrial sector (see table 7.3).

The strategy will involve in most cases the improvement of the institutional framework governing the FIS, extending fishing activities to all areas of the national EEZ and to all major species as well the development of aquaculture. This will require supporting strategies such as increasing productivity and efficiency of both artisanal and commercial sectors of the industry and promoting fish consumption in the domestic market.

Table 7.3. Group 3: Low priority fisheries
(Brazil, Colombia, Gabon, Iran, Iraq, Saudi Arabia, Sierra Leone, Venezuela)

Strategies	Special problems	Relevant Cons- traint	Relevant Enhan cement	Appropriate actions	Examples of ongoing actions
Improve the institutional framework governing fisheries.	Fisheries low priority in national economy.	2 21	1	Reassessment of national goals and priorities. This has already happened to an extent, fluctuating oil prices underlining the importance of domestic food production.	Examination and renewal of fisheries laws and regulations. Redesigning of institutional organization governing fisheries. Co-ordinating fisheries with development plans and policies. (Venezuela)
Increase domestic consumption of fish among all income groups.	General scarcity of skilled manpower for fisheries due to job opportunities elsewhere.	24 7		Development of the fishery sector efficiency and productivity to attract more skilled manpower.	Creation of anew fisheries corporation. Promotion of co operatives among artisanal fishermen. (Venezuela)
Expand fishing to all areas of the national EEZ and all major species.	Low demand for fish in domestic markets.	9		Better marketing and distribution coupled with consumer education programmes.	Improve marketing and distribution of fresh fish. Introduce fish in institutional feeding programmes. (Brazil)
Develop aquaculture, both coastal and inland.	Fishing industries generally undercapitalized.	19	14	Investment by both government and private sector, and creation of more attractive climate for fisheries investment.	Financial assistance to fisheries sector. Promotion of joint ventures in shipbuilding and manufacturing. Technical assistance agreements in fish and shrimp culture. (Venezuela)
Increase productivity and improve efficiency of both artisanal and commercial sectors of the industry.	Although fisheries exploitation is at a fairly low level, the overall resource is not large by global standards.	1	1	Wise use of existing resources. Possibly some joint ventures with non oil producing countries, providing the fuel and capital for fishery exploitation in other country EEZ's.	Tuna fishing venture with non-petroleum country such as with the Saudi/Maldives joint venture companies. (Saudi Arabia)

Suggested actions. A reassessment of national goals and priorities related to the fisheries sector as well as the rationalization of the institutional and legal infrastructure is a first remedial input for this group.

Venezuela has adopted a co-ordinated policy to develop its fisheries sector. It will create a fishing corporation, promote small-scale fishing co-operatives and encourage vertical integration in the industry as well as seek to improve shipbuilding by the use of joint ventures.

A first step which some countries of this group are undertaking is the provision of low-interest credit for artisanal fishermen to facilitate the purchase of boats, engines and fishing gear. This should be no problem for most of the group in view of their oil revenues. Some fishery exports come from the group, particularly shrimp from Brazil and Venezuela and fish meal from Venezuela. Brazil has the largest fishery and the greatest volume of exports but the group also imports much fish, over US$ 200 million, with Saudi Arabia, Colombia and Brazil being the major importers.

Improvements in the marketing and distribution infrastructure would be required and investment by both the government and the private sector to improve the climate of the fisheries among the manufacturing sector.

Mention has already been made of the possibility of the oil rich states co-operating with poorer oceanic countries in joint ventures for export fisheries with the oil country supplying fuel and capital, and the poor country providing the labour and the marine resource. This arrangement could also operate the other way with fishermen from the less affluent state harvesting and processing fish from the waters of the oil producing state where labour is a scarce commodity.

Group 4: Labour-intensive fisheries (Algeria, Egypt, India, Indonesia, Pakistan, Sri Lanka, Tunisia)

Strategy. Group 4 represents the largest group of artisanal fishermen (2.5 million) with a large internal market for fish and growth potential. The fishery industry goals of most of these countries involve production increases and improved distribution to meet local market needs, protection and development of small-scale fisheries to maintain employment, and improvements in harvesting and processing to increase the economic efficiency of the export fisheries. Aquaculture is also important.

The constraints of this group are inadequate capture and processing technology, insufficient skills in most FIS components, lack of appropriate technology for utilization of by-catch, lack of capital for artisanal fishermen and poor legal support for fish farmers.

A strategy to improve food security and the maintenance of employment seems to be the most appropriate for this group.

Supporting strategies would be the development of capital goods industries and general fisheries infrastructure as well as improvements in the quality of processed fish products for exports.

The strategy should pay attention to the conflict between small-scale fishing fleets and ambitious industrial offshore fleets which is most apparent in the four Asian countries of this group.

Suggested actions. Remedial inputs place emphasis on the artisanal sector and include imports of fish to maintain supplies during off-season periods, training, the use of intermediate technology vessels and investments in freeezing and cold store facilities and the improvement of the marketing and distribution systems (see table 7.4).

The four Asian countries, India, Indonesia, Pakistan and Sri Lanka have to some extent, along with others, overdeveloped their offshore fisheries. In South East Asia, some bank loans for fishing fleets were spent on sub-standard or inappropriate vessels and on processing and marketing systems that proved to be expensive and inefficient in operation. The past experience has resulted in a more practical approach and less ambitious goals. Indonesia invested in a comprehensive national scheme of fisheries training and education with excellent results. Sri Lanka is supporting its small-scale fisheries sector and India has been able to train and equip fishing vessel personnel so that fishermen are also available for work on joint venture vessels in Africa and Arabia.

FAO has assisted some group 4 countries in the areas of management, fish culture and socio-economic development of artisanal fisheries. The regional programmes in the South China Sea, Bay of Bengal and Red Sea have pioneered new schemes or technologies for small-scale fishing communities.

Most group 4 governments have had to take action to prevent or minimize conflicts between their industrial and small-scale fishing fleets. More work needs to be done in this area to avoid future disputes. There is a growing consensus towards involvement of local fishing communities in the management and policing of the fishing grounds immediately adjacent to their settlements. This approach has worked very well with some small-scale fisheries co-operatives in Japan.

The escalating costs of fuel and imported machineries and expertise has obliged countries like Indonesia to make their capital intensive distant water fisheries more efficient. Tuna fishing by long line has decreased in favour of pole and line and purse seine methods. There has also been greater involvement of small-scale fishing fleets to support and work in co-operation with deep sea vessels managed by government enterprises. Work is going ahead on the development of ways to utilize the by-catch from shrimp trawlers.

A considerable amount of work needs to be done to improve handling and quality at the thousands of landing places and retail markets in these countries. Clean water, sanitary, shaded premises, basic hygiene and speedy discharge and sales systems are needed if there is to be a significant spoilage reduction and quality improvement. Apart from the fresh fish markets, local canneries require more regular supply of good quality sardines and mackerels.

Having limited fishery resources to exploit, Algeria, Egypt and Tunisia must manage well their extraction and processing industries to minimize waste and maintain production. Aquaculture can be developed and may contribute to modest production increases. In the Asian countries aquaculture has great potential and both Indonesia and India have well developed fish culture sectors in marine, brackish and fresh waters. As in other countries there is a tendency to move from the culture of lower value species like milkfish and tilapia towards higher value carp, shrimp and molluscs.

Table 7.4. Group 4: Labour-intensive fisheries
(Algeria, Egypt, India, Indonesia, Pakistan, Sri Lanka, Tunisia)

Strategies	Special problems	Relevant Cons- traint	Relevant Enhan cement	Appropriate actions	Examples of ongoing actions
Increase fish production to maintain food security and employment.	Some major fishing grounds located very far from markets and population centres.	7 13 15 16	1 9 3	Development of good quality processing and curing in rural areas, improvement of fish transport and establishment of regular schedules for fish collection boats or trucks.	Regional fisheries development programmes including harbours projects, provision of ice plants, cold stores and fish transport vessels, with finance from ADB. (Sri Lanka, Indonesia)
Improve marketing and distribution to raise consumption in inland areas.	Capture and processing technology inefficient or energy expensive in some areas.	3 4 5	6	Increased use of artisanal fishermen and intermediate technology vessels in offshore fisheries. Energy conservation and more efficient energy use in fish plants.	Fleet operation with artisanal tuna fishermen working around a mothership from a large domestic enterprise. (Indonesia) Use of natural energy and fuels such as biogas in fisheries. (India)
Decrease waste by reducing spoilage and by utilizing by-catch from shrimp trawlers.	Fishermen and fish plant operators lack knowledge of modern gear and techniques and of the operation, maintenance and repair of engines and machinery	24		Training of personnel at all levels but with strong emphasis on practical and technical aspects.	Establishment of training centres, academies, colleges and university departments for fisheries. Fisheries research projects on waste fish utilization. (Indonesia)
Increase exports by better quality processing and by harvesting offshore stocks of tuna and shrimp.	Appropriate technology for utilization of by-catch not yet ascertained.		6	Further research and pilot projects.	
Expand aquaculture both for food fish and for export species.	Fish canning plants lack continuity of supply.	27		Better marketing and distribution, more freezing and cold store facilities at distant ports. Purchase of frozen fish from abroad to maintain supplies in off seasons.	Joint venture agreements with foreign fleets and fish suppliers. (Egypt, Tunisia) Artisanal-private sector co-operation in capture and supply of fish. (Indonesia)
Develop support industries and general fisheries infrastructure	Artisanal fishermen lack capital and often operate at the mercy of markets and merchants.	21	6	Establishment of co-operatives, small scale credit schemes and support by extension services.	Ministry of co-operatives, fisheries projects K.I.K(small scale credit Indonesia) fisheries programmes. Fisheries extension service and co-operative establishment. (Indonesia)
	Fish farmers have difficulty getting legal access to land and water. Fish culture is mostly integrated with small scale agriculture or animal husbandry.		14	Integration of aquaculture with rural development programmes. Simplification of legal and administrative procedures. Support by extension services.	Fish pond development programme, S. Sumatra, S.F.D.P. ADB project. Bilateral and World Bank aid for brackish water ponds. (Indonesia)

Group 5: Small states with growth potential (Congo, Fiji, Guyana, Oman, United Arab Emirates)

Strategy. Countries in group 5 have considerable growth potential, especially in the fish export sector. They have small populations (mostly less than one million) and, therefore, do not have large domestic markets to supply.

Kiribati and Fiji have good tuna resources, Guyana has a shrimp export industry, Oman and the United Arab Emirates have large stocks of pelagic and mesopelagic species. The Congo and Guyana have good freshwater fisheries and aquaculture potential. Given the lack of processing facilties, around 90 per cent of the fish is supplied fresh with a large percentage of spoilage.

To promote export trade should be the main objective for this group, in the case of Guyana it should be complemented by the food production objective for the internal market.[30]

The main strategy of group 5 should be the expansion of the fisheries activity both for export and the domestic market based on the improvement of the fisheries secondary sector (see table 7.5).

The development of exports should come from exploting offshore waters and the development of marine aquaculture, increased processing, and the incorporation of artisanal fishermen in industrial ventures.

Suggested actions. The countries in this group, which are relatively small non-industrialized states, do not have the capital or industry to develop their fisheries without outside assistance. They are therefore, obliged to use joint ventures to utilize the offshore fishing grounds and process fish for export, while investments are made in fleets and plants through special loans.

While good fish resources appear to exist off the shores of group 5 countries, none of them have been properly researched or quantified. A survey programme is consequently needed to determine more accurately the size and nature of fish stocks. This is required in all these states except the Congo which has a very short coastline. Guyana is proceeding with its marine fisheries survey and hopes to attract more foreign fleets to fish under license or as joint venture partners.

The fishermen of group 5 are nearly all artisanal and some training and credit assistance would be essential to enable them to participate in the offshore fisheries. Guyana plans such training for its small-scale fishermen, plus assistance through their co-operatives. The U.A.E. government provides financial assistance for its fishermen to acquire boats, engines and nets.

Aquaculture has potential in Guyana and the Congo and there are ongoing training programmes for both. There may be a small potential for giant clam or oyster production in Fiji and Kiribati.

30/ Since 40 per cent of the proteins available come from fish.

Table 7.5. Group 5: Small states with growth potential
(Congo, Fiji, Guyana, Kiribati, Oman, United Arab Emirates)

Strategies	Special problems	Relevant Constraint	Relevant Enhancement	Appropriate actions	Examples of ongoing actions
Development of fish export industry, exploiting offshore waters.	Lack of large offshore fishing vessels and processing plants.	13 24	9,3,12	Use of joint venture agreements in the short term, while investments are made in fleets and plants, with assistance from development banks.	National fleet development while joint venture fishing enterprises continue at present. Training of local personnel on joint venture vessels. (Fiji)
Establishment of processes to prepare products from less exploited species and by-catch.	Insufficient knowledge of size and condition of fish stocks.	24	1,6	Resource survey possibly with FAO assistance. Fish stock assessment.	Research survey by national vessels. (Guyana) Short term surveys by U.N. research ships. (Oman, United Arab Emirates)
Incorporation of artisanal fishermen in industrial fisheries ventures.	General processing and quality standards inadequate for export trade.	4		Upgrading of infrastructure and procedures. Training of fish handling and processing personnel.	Investment in port handling facilities, markets, ice plants and cold stores. Training courses for fisheries staffs. (Guyana)
Reduction of waste losses and upgrading of product quality.	Need to maintain job opportunities in the fisheries sector.	24		Use of labour intensive technologies wherever possible. Selection of intermediate systems.	Credit and services for small scale fishermen Introduction of less energy expensive technologies. (Guyana)
Development of freshwater and marine aquaculture.	Difficulties in determining workable arrangements and processes for the economic utilization of by-catches and of deep water mesopelagic species.	7		Continued research and pilot projects on fish processing and marketing. Sharing of information and experience with other similar country fisheries.	Introduction of new technologies of producing surimi, fish sausage or fish protein concentrate. Marketing and consumer testing programmes. (Guyana)

The processing sector requires attention in all six states, in Fiji and Kiribati to upgrade and increase export produce, and in the others to improve and diversify local curing and processing. Guyana has a well advanced programme in this field and has been making special efforts towards utilization of by-catches. Artisanally-cured fish in the Congo, if well prepared, can be exported to Zaire and other neighbouring states. If the mesopelagic species of Oman are to be utilized, they will either have to be converted into fish meal or fish protein concentrate. Another and less expensive alternative would be to make fish silage by adding acid. The silage can later be dried or fed to animals in its liquid state. Continued research and pilot projects for the introduction of new technologies should be supported.

Overall the fisheries prospects for group 5 are good, both for employment and for income, however upgrading of infrastructure and processing are necessary.

Group 6: Large but fluctuating resources and limited local demand for fish
(Argentina, Chile, Ecuador, Namibia, Panama, Peru, Uruguay)

Strategy. Group 6, the most industrialized of all the fishery groups, brings together major processors, exporters and meal producers. Most of the states have in common that until recently they paid little attention to their domestic markets or to their artisanal fishermen, but recently there have been changes in policy and in fisheries goals. Countries of this group have been characterized by drastic fluctuations in stock and/or soaring energy costs and limited market outlets, leading to over-capitalization of the harvesting and processing sectors. Fish farming has a good potential in this group.

The fluctuations in stock and economic problems in the processing sector due to soaring energy costs and limited market outlets have in several countries of this group affected both the fish meal and fish canning industries. Largely because of its dependence on a single species and a single product Peru was most affected. This has been the main motivating factor in the present drive for diversification in capture and processing, the lowering of processing costs, and the development of other markets, especially domestic ones.

Ecuador and Panama have also suffered to a degree from fluctuating resources, but Chile less so as it is presently benefitting from environmental changes which have brought major increases to pelagic stocks in its EEZ. Namibia no longer produces fish meal since reductions in fish stocks, mainly South African pilchard, occurred.

Objectives for this group would be resource management/utilization, export trade, the promotion of the internal market and of the artisanal sector.

A diversification based on fish resources and markets with a potential for growth over an acceptable industrial base should be the strategy for this group. Industrial rehabilitation and sound resource management approaches should be important components for the implementation of this strategy. Diversification through expansion should be cautious in view of present over-capitalization. The attainment of a more balanced and efficient FIS should be the result of this strategy. Priorities for investment should come from careful planning. The development of the capital goods sector should be encouraged in order to reduce dependence (see table 7.6).

Table 7.6. Group 6: Large but fluctuating resources and limited local demand for fish (Argentina, Chile, Ecuador, Namibia, Panama, Peru, Uruguay)

Strategies	Special problems	Relevant Constraint	Relevant Enhancement	Appropriate actions	Examples of ongoing actions
Diversification of fisheries in capture technologies and species produced.	Fluctuating resource of anchovy and small pelagics.	27 1	7 12 9 11	Better management of fishery and monitoring of fish stocks.	Further research on offshore resources, including demersal as well as pelagic stocks, and strict control of levels of exploitation. (Peru)
Development of domestic markets.	Dependence on export markets for much of the industry.			Development of domestic markets and diversification of export fish products.	Nationwide programme of consumer education coupled to fish promotion and institutional feeding. Use of unfamiliar fish species in new products or food dishes (Peru)
Reduction of dependence on imported vessels and machineries.	Domestic markets not traditionally interested in fish.	9	13	Consumer education and promotion of fish protein foods.	Export of shellfish, slamon and demersal species in addition to canned sardines and fish meal, fish oil products. (Chile)
Upgrading of quality and value of exported fish products.	Energy costs of offshore fisheries a serious economic constraint.a/	26		Development of low fuel consumption vessels and incorporation of energy saving practices and systems in fish plants.	Use of factory ships and low fuel consumption catcher vessels in offshore fisheries. Rationalization of plant capacity and use, phasing out of energy expensive systems. Use of alternative can and packaging materials. (Peru)
Nurturing of the artisanal fisheries sector.	Previous over investment in vessels and fish meal canning plants leaves some of these unused or underutilized.	18		Conversion of ships and factories where possible. Careful monitoring of future investments to avoid overcapitalization of profitable sectors. Investments in port facilities and in cold chain.	Former anchovy seiners converted to tuna fishing or demersal trawling. Fish meal plants re-equipped for canning and freezing. (Peru)
Reduction of packaging and energy costs of processing.	Neglect of small scale fisheries.	26		Special aid to assist artisanal fishermen.	Support for the artisanal fishing sector, with credit, technical assistance, marketing help. (Peru, Ecuador, Panama)

a/ At present applicable essentially to Chile and Panama.

Suggested actions. Better management of resource and monitoring of fish stocks are priority actions for most of the countries in this group. To compound the problem of drastically declining catches, Peru and others had to cope with an over-capitalization of the fish harvesting, meal and canning processing sectors. Vessels built exclusively to purse seine for anchovy had to be converted to demersal trawling or tuna fishing or otherwise lie idle in port and fish meal plants had to be converted to canning, freezing or curing. Such renovations of plant and vessels was expensive and there was a limit to the amount of diversification the market could support in the short-term. In view of this the new Peruvian fishery plans call for a considerable degree of diversification and substantial efforts to increase domestic fish demand and improve distribution.

Argentina and Uruguay were less affected by changes in stocks and markets, but they have suffered from inflation and rising energy costs and are more aware of the value of their fish resources, both for domestic consumption and as an export commodity.

To reduce harvesting costs and increase employment, Peru is giving greater assistance to its artisanal sector. Only the most distant or inaccessible of marine fish stocks are to be reserved for industrial fishing fleets. Some use will be made of foreign fishing companies to harvest and process species that the local fleet and plants may not yet be equipped to handle.[31]

Processing costs are to be reduced by more rational utilization of existing plant, by reductions in energy consumption and by use of cheaper canning and packing material. There is to be greater investment in port facilities, cold stores, ice plants, freezers, and transport facilities.

An extensive consumer education programme will go hand in hand with improvements and diversifications in fish products. This will include institutional feeding projects and use of fish protein in school meals. Universities, research institutes and private sector interests will co-operate in these programmes and support or sponsor certain elements.

Moves into diversification and towards fish food sufficiency as well as action programmes have been undertaken. There may be a need for regional co-operation in developing harvesting and processing techniques for new species and new products. Joint ventures should be pursued in order to keep up with the pace of technological changes. Progress in reducing energy costs and packing or canning material costs would be of immense benefit to other developing fisheries elsewhere in the world. FAO or UNIDO could assist in energy use surveys and in disseminating information on processing and packaging technology options.

Group 7: Laissez-faire fisheries (Area of Hong Kong, Côte d'Ivoire, Malaysia, Philippines, Republic of Korea, Thailand)

Strategy. Group 7 countries' fisheries are predominantly run and financed by the private sector. They are well developed and have healthy production and marketing sectors. What they lack in unexploited resources,

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31/ UNIDO is presently carrying out an assessment and programming exercise for the Peruvian FIS using the MEPS methodology (project no. UC/PER/86/029).

they make up for in diversified processing and aggressive marketing. There are also significant aquaculture developments in group 7 states, with a wide variety of species from seaweeds and molluscs to freshwater prawns and aquarium fish. The countries as a group are well poised to develop shipbuilding, engineering and processing industries to support expansion of the fisheries sector.

The main constraints for this group are undoubtedly resource limitations, a gap between domestic demand and supply and high rates of spoilage in fresh and cured fish. Distance of fishing grounds and consumer centres and conflicts between commercial and artisanal fleets are also important constraints.

The Republic of Korea is well advanced in shipbuilding and Thailand in boatbuilding, Malaysia has many emerging small industries and the Philippines have adapted technology to local needs.

Resource managing/utilization should be the main objective of this group, followed by the promotion of markets. The strategy appropriate to the group should address both the export and the internal market and seek the optimization of all components of the FIS giving high priority to managing and policing activities to protect limited fish resources.

To attain the first objective, it would be necessary to maximize the use of EEZ resources, develop aquaculture and reduce fish losses (see table 7.7).

The strategy also calls for expansion and diversification of trade. Caution should be used to protect artisanal fishermen when supporting industrial fishing operations and to prevent environmental destruction when promoting aquaculture development. Careful assessment of options should be applied, simulation of investment and policies should be made before programming further development of the fisheries in this group.

Suggested actions. Programmes of conservation and management of the resource and legal protection measures of artisanal fishing grounds are some of the proposed policy remedial inputs. Development of fuel-economic vessels and trucks, vertical integration in marketing and investment in fish infrastructure, the cold chain and the introduction of food quality programmmes as well as appropriate methods to reduce spoilage in curing are the industrial remedial inputs.[32]

Processing methods are fairly well advanced in this group. Apart from the larger exports of tuna, shrimp and canned sardines, the African countries export special fish products like sauces and dried squid to the United States and Europe and the Côte d'Ivoire exports canned and cured fish to Europe and Africa. There is room for expansion in the trade of these items and in further diversification and quality improvement.

32/ Thailand's trawler fleet is already heavily exploiting the waters of the Gulf of Thailand and has been prohibited from fishing in the adjacent waters off Malaysia and Burma. The Philippine tuna industry has alarmed biologists by harvesting large quantities of juvenile fish, and its "baby" trawlers have denuded many inshore areas of fish.

Table 7.7. Group 7: Laissez faire fisheries
(Area of Hong Kong, Côte d'Ivoire, Malaysia, Philippines, Republic of Korea, Thailand)

Strategies	Special problems	Relevant Constraint	Relevant Enhancement	Appropriate actions	Examples of ongoing actions
Maximize use of existing EEZ marine resources.	Marine resources already well exploited. Only limited possibilities for expansion.	1	11 7	Programmes of conservation and enhancement of marine fishing grounds. Balanced harvesting of all available fish stocks. Aquaculture.	Survey of the marine fish resources of the South China Sea. (Malaysia) Creation of fish sanctuaries, mangrove plantations and artificial reefs. (Philippines)
Develop aquaculture production.	Small scale fish farmers have difficulty gaining local access to land water.		14	Legislative, administrative and financial assistance to fish farmers, possibly incorporated in rural development projects for small scale producers and artisans	Bumiputra fisheries credit and assistance projects. (Malaysia) Rural development banks/Bureau of fisheries assistance programmes for fish farmers. (Philippines)
Maintain supplies to meet domestic demand and to expand export sales.	Domestic demand growing faster than supplies, export species also limited in production.			Control of spoilage and waste, better distribution, introduction of less familiar species in domestic markets.	Fish quality control programmes. Use of solar driers and methods of producing pickled and and fermented fish products. University and college extension services. (Philippines) Import of foreign caught fish for processing in local plants before re-exporting(Thailand)
Continue to encourage assistance and protection to traditional artisanal fishermen.	Distance of fishing grounds and of fishing ports from population centres adds to production costs, especially in fuel and transport.	7 16		Development of fuel economical vessels, insulated and refrigerated vessels and trucks, some vertical integration and efficiency in handling and marketing.	Use of fish carrier vessels to transport fish from the islands to the main navotas fish market. (Philippines) Insulated fish trucks and containers for land transport of fish. (Thailand)
	Growing conflicts between commercial and artisanal fleets on inshore fishing grounds. Small scale fishermen lack credit facilities.	2		Reservation of inshore fishing areas for local artisanal fishermen. Provision of fishery protection vessels. Prosecution of offenders.	Inshore/offshore fisheries management programmes. (Philippines, Malaysia, Côte d'Ivoire)
Reduce fish losses and raise value of fish products.	Spoilage rates average 10% for fresh fish and 95% for cured fish. Some fish is reduced to fish meal for animal feed.		3	Investment in fish landing facilities, markets, ice plants, cold stores, clean water supplies. Manufacture of fish protein concentrate or fish silage.	ADB, World Bank and bilateral aid projects for Visayan island fisheries, providing infrastructure, equipment and vessels. (Philippines) Use of low energy cost systems of fish silage manufacture. (Thailand)

Although they have big commercial sectors, group 7 countries also have large populations of artisanal fishermen. Their livelihood needs to be protected and strong measures taken to keep commercial fleets out of inshore waters. This can only be achieved by adequate policing at sea and strictly enforced penalties for infringements.

Aquaculture potential can be developed and may add significantly to overall production, especially of higher priced species. Developments need to be controlled to prevent destruction of large areas of mangroves to make room for huge brackishwater ponds. There is less market demand in group 7 for freshwater fish than in the geographically similar group 2, thus there may be more emphasis on marine fish culture. Seaweeds and molluscs will form the bulk but prawns, clams and oysters will also be important. The shell and coral ornamental industry of the Philippines is an example of a by-product from fishing being used to create a large and flourishing cottage industry in coastal towns and villages.

Group 8: Lack of industrialization (Mauritania, Somalia)

Strategy. Group 8 has only 2 states, Mauritania and Somalia, both desert countries with large marine fish resources.

Mauritania has a fairly well developed processing and export industry while Somalia has hardly begun to develop its fishery. Both countries rely heavily on foreign assistance, mainly in the form of joint ventures. Their fish produce is primarily for export. Mauritania has some industrial base to build on but Somalia lacks the basic infrastructure and services to support an offshore fishing industry.

The strategy should place emphasis on fish production for exports because of large offshore resources and present limitations on internal demand. Nonetheless, encouragement should be given to artisanal fisheries as well as to promotion of domestic consumption, especially in Somalia where food is scarce (see table 7.8).

Suggested actions. The example of joint ventures and licence fishing by foreign fleets in Mauritania could be also followed by Somalia, where the possibility of phasing these out as its own fleet grows and its fishery manpower is upgraded, will take longer than in Mauritania.

For Somalia a greater degree of technical assistance is necessary and development plans must include the whole sector - catching fleets, landing places, harbours, repair and maintenance services, handling and processing, transport and marketing. Joint projects to develop Somalia's fishery, while at the same time using much of the initial production in famine relief feeding programmes, should be encouraged.

Group 9: Likely exporters (Maldives, Senegal, Solomon Islands)

Strategy. Group 9 groups three countries with healthy fisheries which are poised to move from being predominantly domestic market to being mainly export market oriented. One is in West Africa, one in the Indian Ocean and one is the South West Pacific. All have good tuna resources offshore and one, Senegal, also has several other species of importance in its EEZ. Most of the pre-requirements of a flourishing fishing industry are present in this group.

Table 7.8. Group 8: Lack of industrialization (Mauritania, Somalia)

Strategies	Special problems	Relevant Cons-traint	Relevant Enhan-cement	Appropriate actions	Examples of ongoing actions
Harvest and process offshore fishery resources, primarily for export.	Lack of capital, inputs and infrastructure and shortage of skilled personnel.	10 13 14 24	1 12 9	Use of joint venture fleets in fish capture and joint venture or foreign investment in fish processing plants.	Construction of two fishing ports with processing plants and ship servicing facilities, on the edge of the desert, financed by local and foreign investment and joint ventures which also supply most of the fishing vessels. (Mauritania)
Encourage artisanal fishing and promote domestic consumption of fish.	Fish not traditional in local diets and no long history of fishing activity.	9	9	Education and training of fishermen and fish curers. Assistance in marketing and distribution. Use of fish protein in nutritional programmes. Programmes for increasing fish in the diet.	World Bank project to exploit offshore fish stocks and develop local capability and infrastructure. (Somalia) Support for local artisanal fishermen and formation of co-operatives supplemented by educational programmes at the consumer level. (Somalia)

a/ See tables 3.1. and 3.2 for description.

Given the large potential for export-type fish, e.g. tuna, a more efficient use of this resource could be achieved by involving both advanced and intermediate technologies and investing in local porcessing and infrastructure. In the latter the skills of the artisanal sector could be well integrated. The importance of fish in the domestic diet, although already high in the coastal areas, could still be improved and extended to inland areas. The important role which the artisanal sector presently plays as a supplier and distributor in the domestic consumption should be maintained and further improved (see table 7.9).

The present pattern of this group is a good example of complementarity between the artisanal and the industrial fisheries. Both can play an equally important part in achieving simultaneously the two objectives of export and food production for the internal market. The role of government in maintaining the proper balance between artisanal and industrial sectors is of critical importance.

Suggested actions. Senegal has a comprehensive and well prepared plan of action for fisheries development that includes the use of joint ventures, expansion of local fleet, training and investment in processing facilities. Most of its elements would be applicable to the Maldives and Solomon Islands although their fisheries infrastructures are not as well advanced.

The plans include provisions to strengthen both domestic and export trade and to increase the amount of Senegalese ownership and participation in the fishery. Foreign license agreements are to be closely monitored while the local fleet is modernized and expanded. Considerable attention is also to be paid to the artisanal fleet to maintain employment and raise incomes. Under the CEPAS project they will be able to obtain engines and fishing gear on attractive credit terms. Under the "priority action programme" most of the money for fisheries, some 59 per cent, will go to artisanal fisheries and aquaculture. Inland projects will be of an integrated nature and involve de-centralization of infrastructure.

Unlike Maldives and Solomon Islands which must build up their processing facilities, Senegal has an adequate number of plants but many of them require rehabilitation and modernization. Energy and packing costs are a serious constraint and are to be given close attention. There are a number of energy saving systems and alternative energy production methods now available which could be applied to fish processing plants in the tropics.

Incorporation of climatically appropriate energy systems could greatly reduce costs for countries such as these which do not have internal resources of petroleum fuels. The investigation of alternative energy systems when planning projects should be given priority.

Senegal also plans to assist its domestic fish traders with credit and with some technical assistance in hygiene and fish handling. Two examples of appropriate technology in fish handling in Senegal are the insulated ice/fish boxes built of local materials and designed specially for the pirogue fishing boats in one case and the small trader trucks in another. Indonesia recently incorporated iced sea water tanks for sardine in its large tjompring canoes fishing in the Bali Strait. The Maldives and Solomon Islands fisheries should also make maximum use of local materials and skills while developing their offshore tuna fisheries, and import only those systems which cannot be built locally in full or in part.

Table 7.9. Group 9: Likely exporters
(Maldives, Senegal, Solomon Islands)

Strategies	Special problems	Relevant		Appropriate actions	Examples of ongoing actions
		Constraint	Enhancement		
Develop export fisheries	High operating costs of fleet (aging and inappropriate fleet).	13 26	1 12 13	Use of joint ventures for offshore and export fish harvesting. Monitor license agreements. Expand and modernize local fleet.	Joint ventures in tuna fishing industry. (Maldives, Solomon Islands) Development of local deep sea fishing fleet. (Senegal, Solomon Islands)
Incorporate local artisanal fishermen as far as possible in fish capture offshore.	Little alternative employment for local fishermen.	24	4	Training of local fishermen and placing them on joint venture ships and plants. Development of local fleet.	Technical assistance and credit for local artisanal fishermen. Raising skills and improving technologies. Diversification of fishing effort, multi-species fisheries. (Senegal)
Invest in local processing capability and infrastructure.	Absence of infrastructure and particularly modern fish processing plants.	16 7	9	Investment in processing facilities with World Bank or foreign assistance. Incroporate climatically appropriate energy systems.	Tuna fish freezing and canning plant project (Solomon Islands) Credit and technical assistance for small fish traders to improve equipment, processes and transport of fish. (Senegal)

Group 10: Long distance, state controlled (Cuba, Democratic People's Republic of Korea)

Strategy. Group 10 has two countries with socialist economies and flourishing fisheries. The larger of the two, the Democratic People's Republic of Korea has enormous fish resources to exploit while the smaller, Cuba, is already fishing its modest resource to the full and is obtaining additional supplies from international waters and from licensed fishing in other EEZs. The Democratic People's Republic of Korea also does some fishing outside its EEZ waters. Both countries have very high domestic fish consumption and are primarily interested in their internal markets.

A considerable amount of processing takes place in the two countries of this group. Cuba has an excellent system of distribution and marketing that makes fish available in every part of the country. The Democratic People's Republic of Korea has much work to do in this respect having a larger country and more difficult terrain. There is also a need there for greater efforts in fish handling and quality control (see table 7.10).

The countries in this group have the skills and some of the capital inputs and infrastructure required by an efficient commercial fishing industry. Only two constraints affect them: limited resources (Cuba) and poor marketing and distribution for the Democratic People's Republic of Korea. The government high priority for fisheries is an asset for the implementation of the suggested actions. The main objective of this group is to increase production for the internal market which would mean expansion of fleet and fleet services to exploit more EEZ waters in the case of Cuba and improving handling and distribution in the Democratic People's Republic of Korea.

Suggested actions. The practice of group 10 countries of fishing beyond their EEZ waters is one which might encourage other states whose fishing zones are small or already well exploited. In some cases it is possible to fish successfully beyond the EEZ limits and in others to fish under license in a neighbour's EEZ. Aquaculture is also an interesting area of activity for this group.

The emphasis on processing and distribution is also of interest to countries with large domestic requirements for fish protein. Investments in the basic infrastructure, transport, services, training should be important supporting actions to be considered.

7.3 A résumé of development actions

Whereas the previous section describes development actions by group, this material can be brought together to provide a perspective on an FIS component basis. This is done in two sections. First, the by-actions groups are summarized in section 7.3.1. Second, these results are disaggregated into activities in sections 7.3.2.

Table 7.10. Group 10: Long distance, state controlled
(Cuba, People's Republic of Korea)

Strategies	Special problems	Relevant Cons- traint	 Enhan- cement	Appropriate actions	Examples of ongoing actions
Maximize production to meet large and growing domestic demand.	Marine EEZ resource fully exploited now. (Cuba)	1	9	Exploitation of non-EEZ waters. Licensed fishing in other EEZ grounds. Development of aquaculture.	Both Cuba and People's Republic of Korea operate to some degree in international waters. Cuba also fishes in other country EEZ's under license or joint venture agreements.
Improve fish quality and distribution.	Inland distribution difficult and fish/ handling/processing inadequate (P.R.Korea)	7		Investment in fish handling, preservation and transport systems. Training of fish workers in quality control.	Cuba has well developed system of fish distribution to every town and village to maximize fish protein consumption amongst rural population.

a/ See tables 3.1 and 3.2 for description.

7.3.1 Summarizing development actions by component

A résumé of the suggested actions, identified in the previous section is given in table 7.11. The first section of the table refers to investments by component: resource management, extraction, processing, distribution and marketing, domestic and foreign trade as well as fisheries infrastructure. The second half of the table lists the required support actions and mechanisms referring to general infrastructure, training and extension, government policies, research and development, credit and finance, joint ventures and technology.

It is important to remember that the suggested actions are considered priority actions in order to overcome the most important problems that hinder the application of the group-specific strategies. However, great care should be taken not to implement them partially, since they were designed to be applied in an integrated manner.

The quantification of these actions should come after the full application of system-oriented analytical tools such as MEPS (methodology for assessing and programming production/consumption systems) at the individual country level. This application would be one step further than the country case studies undertaken for the present study.[33]

Priority actions

Investments. The most frequently required investments are found in distribution and marketing components followed by extraction fisheries infrastructure and resource management, and then by processing. Investment in the promotion of trade, internal as well as export markets are not required to the same extent. The main requirements for investment in the industrial inputs (extraction, processing and fisheries infrastructure) are the construction of economical and appropriate vessels, investment in cold chain equipment and the implementation of improved fish transport systems. Harbours and ancilliary equipment and fish markets rate high among the fisheries infrastructure investments required. The new regime of the seas justifies the high investments required for resource management. Among these the most frequent requirements are monitoring, aquaculture and survey followed by policing and conservation. Investment in aquaculture is justified because aquaculture is one of the important options open to developing countries for increasing the production of fish.

In distribution and marketing investments in improved fish transport systems are most required, followed by cold chain and cold store facilities and the construction of harbours and markets. Within the improvement of fish transport systems the main activity to be encouraged is the standardization of fish containers and supplies of packing materials. This requires an investment in the manufacture of standard and refrigerated trucks. The high investment requirements for distribution and marketing is due to very high losses of fish through spoilage through lengthy handling and inadequate facilities. The amount of losses of fresh fish due to this reason has been estimated as 1.7 million tons, or 10 per cent of all fresh fish caught.

33/ Only the first step of MEPS, a simple disaggregation or diagnostic stage, was applied to the case studies, presented in chapter 5.

Table 7.11. Group-specific actions

INVESTMENTS	GROUPS a/									
	1	2	3	4	5	6	7	8	9	10
RESOURCE MANAGEMENT										
- Survey					x			x	x	
- Monitoring		x	x	x		x			x	
- Policing					x	x				
- Aquaculture	x			x	x		x			x
- Conservation						x	x			
- Extension to non-EEZ waters										x
EXTRACTION										
- Ice plants	x				x		x			
- Design and construction of energy economical and appropriate vessels	x	x		x	x	x	x			
- Fish ponds	x									
- Conversion of vessels						x				
- Develop local fleet						x			x	
- Fishing gear			x				x			
- Instrumentation			x			x	x			
PROCESSING										
- Energy economical plants & processer	x			x		x				
- Improved methods of fish curing		x		x			x		x	
- By-catch utilization					x		x			
- Selective rehabilitation		x			x	x				
- Low cost packaging						x				
DISTRIBUTION & MARKETING										
- Cold stores	x		x	x	x					
- Cold chain		x	x	x	x	x	x			
- Improved fish transport systems	x	x	x	x			x		x	x
- Rationalization		x	x				x			
FISHERIES INFRASTRUCTURE										
- Harbours	x	x			x	x	x	x		
- Boatyards	x									
- Marine engineering workshops	x									
- Fish markets	x	x		x			x	x		
- Upgrading					x					
TRADE										
- Domestic promotion			x			x		x	x	
- Export promotion						x			x	

a/ Groups:

1	2	3	4	5	6	7	8	9	10
least favoured	state controlled	low priority	labour intensive	high priority	fluctuating resources	laissez faire	lack of industrialization	likely exporters	long distance state controlled

Table 7.11. (continued)

SUPPORT ACTIONS AND MECHANISMS	GROUPS a/									
	1	2	3	4	5	6	7	8	9	10
GOVERNMENT POLICIES										
- Integrated development policies	x	x	x	x	x	x	x	x	x	x
- Goals and priorities			x							
- Institutional & legal infrastructure			x	x			x		x	
- Standardization of imported machinery	x									
- Promotion of co-operatives			x	x						
GENERAL INFRASTRUCTURE										
- Roads and transport system	x				x					x
- Water supply	x	x		x						
TRAINING AND EXTENSION										
- Mechanics and technicians	x			x					x	x
- Quality control		x		x	x	x	x	x		x
- Extension services	x			x						
Fishermen										
- Basic	x	x	x	x	x			x	x	x
- Intermediate	x	x	x	x	x			x	x	x
- Advanced	x	x		x	x			x	x	x
RESEARCH & DEVELOPMENT										
- Resource						x				
- Processing					x		x			
- Marketing				x	x					
- Climatically appropriate energy systems	x						x		x	
TECHNOLOGY										
- Fuel/energy conservation systems	x									
- Transfer of intermediate technologies	x			x	x		x		x	
- Transfer of advanced technologies		x	x						x	
CREDIT & FINANCE										
Credit										
- Industrial			x						x	
- Small-scale			x	x	x	x	x			
Monitoring investment										
- Local govt/private		x				x				
- International		x				x				
JOINT VENTURES										
- Fleet		x			x			x	x	
- Processing			x		x			x		
- Marketing		x	x		x				x	

a/ Groups:

1	2	3	4	5	6	7	8	9	10
least favoured	state controlled	low priority	labour intensive	high priority	fluctuating resources	laissez faire	lack of industrialization	likely exporters	long distance state controlled

Improvements in marketing and distribution facilities and methods are also necessary for promoting fish consumption[34], especially in those countries where the levels of consumption are below 5 kg/capita per year and/or in those where the contribution of fish is very high (up to 40 per cent of the total animal protein consumption). These facts explain the need for domestic trade related priority actions in groups 3, 6, 8 and 9. These actions should be accompanied by consumer education and institutional feeding programmes[35] in the case of those countries where low levels of consumption prevail.

In extraction the construction of vessels is the most frequent requirement which should be viewed together with the development of the local fleet and the availability of iceplants. In this sense the main activity is to do integrated projects involving all village activities including fishermen/boat builders, and the best investment is to assist local boat builders and incorporate alternative material in the construction of vessels. The local production of fishing gear and instrumentation appears only in groups 3, 6 and 7 where the general level of industrial development is high. The activities linked with fishing gear and instrumentation should tend to introduce and to use fish detection instruments and fisheries charts, and appropriate offshore and deepwater fishing gear. It is important that the investment be encouraged for equipping local workshops.

In processing, the greatest need is for investment to improve methods of fish curing. Cured products are usually for the local market and around 25 per cent of dried/cured fish is lost annually through spoilage. The main activity, therefore, should be to reduce losses and improve the quality of cured fish. Consequently, investment should be encouraged in solar fish driers and solar disinfection units as well as in equipment and facilities for sea salt production. Energy efficient plants and processes are seen to be important for groups 1, 4 and 6 and selective rehabilitation for groups 2, 5 and 6. Finally, energy consumption rates are important and an investigation of possible economies in operation are activities to be encouraged. Such energy economies could be attained through investment in improved insulation, plant upgrading and the installation of more efficient processing units. Investments are also required in the construction of energy efficient buildings and in the use of locally available renewable energy sources. The rehabilitation should not be generalized, but should address the problem of over-capitalization and should promote the rationalization of specific industrial processing lines.

Support actions

The support action most widely required is training, which is a generalized need for all groups. The most important need is for the training of fishermen, followed by training in quality control.

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[34] Consumption has a very heterogenous distribution among developing countries (see table 2.13).

[35] See tables 2.12a and 2.12.b for examples of these two types of actions.

Credit and finance and joint ventures are important mechanisms for the development of the FIS together with specific government policies and research and development. Direct transfer of advanced technology seems to be less required. This is probably due to the fact that this activity is implicit in several other mechanisms such as training, research and development, and the use of joint ventures.

The credit requirements are mainly for small scale, the type of credit that is usually scarce in developing countries.

Government policies. The establishment or improvement of institutional and legal infrastructure is an important support action. It is interesting to note that only in group 3 countries have governments generally not considered fisheries as a priority sector. For all other groups a high to medium government priority has been given and though goals have often been established, integrated development policies usually have not been developed and applied. For this reason, the establishment of such policies appears as an important remedial input for all groups.

Research and development needs for resources are specified only for group 6, where a diversification strategy based on fish resources and markets was found to be most appropriate. However, research on resources is implicit in survey and other management activities. Other research requirements relate to processing, marketing and climatically appropriate energy systems. These are areas where results obtained at a local research institution could easily be transferred to other countries in the group and eventually to other country groups. The possibility of promoting joint co-ordinated research work for countries within a group should also be explored.

Table 7.11 gives at a glance, an idea of the multiple actions that have to be taken by the government, by the private sector, promoted by international and bilateral agencies and aid groups and supported by international development banks and other agencies. The discussion of the role of each agent is not considered to be within the scope of this present study.

7.4 Opportunities for co-operation among country groups

There is considerable scope for technical co-operation between developing countries. Several states in major fishery regions are already working closely on resource management and assessment. Technical assistance between states has taken place mainly through the FAO TCDC programme and through regional associations like ASEAN. Some commercial interchange and co-operation takes place, particularly in marketing and this has received a substantial boost from the four regional fish market information units, INFOPESCA, INFOFISH, INFOPECHE and INFOSAMAK.

Considerable expertise exists in fish culture in Asia and the Far East, in processing and marketing in Latin America, and in specific capture technologies and management regimes in particular countries in each of the continents. To date there has been little direct interregional co-operation except through UN and international development bank projects and efforts could be made to promote south-south co-operation utilizing additional mechanisms to the ones mentioned above.

Countries with good experience in offshore capture fisheries are represented in groups 2, 4, 6, 7 and 10. These include Morocco, Mexico, Indonesia, Chile, Peru, Republic of Korea, Thailand, Democratic People's Republic of Korea and Cuba. States with well developed artisanal fisheries in groups 4, 5, 7 and 9 include Indonesia, Oman, Philippines and Senegal. Countries with some years of experience of foreign fleets fishing under licence or in joint ventures are Nigeria, Mozambique, Indonesia, Mauritania and Maldives in groups 1, 2, 4, 8 and 9.

High quality artisanal processing skills are found in the Far East, particularly in the Philippines and Thailand (group 7) but also in some countries of West Africa and Central America. Export processing industries are mainly in group 7 countries (Chile, Ecuador, Peru, etc.) with some in group 2 (Morocco, Mexico, Mozambique).

Important fishing countries with expertise in aquaculture are China (group 2), Indonesia (group 4), Ecuador (group 6) and the Philippines (group 7). Brazil, Chile and India also have advanced systems for growing certain species.

Some more specific examples of technology expertise which might be usefully transferred within regions are listed below in table 7.12.

7.5 Summary of required technical assistance activities and investment

The identified technical assistance and investment requirements are summarized in table 7.13. This summary is made according to the components of the fisheries industrial system rather than according to countries or country groups (country-specific actions are presented in the main study).

On the basis of these results country-focussed programmes and projects to promote the development of the industrial activities required to stimulate the full use of the fish resources will be developed. This will require co-ordinated actions with FAO and other international organizations. Similarly, through its investment promotion mechanism - and following its regular procedures - UNIDO will be able to help attract necessary investment resources. At the request of interested countries further detailed studies could be made: first, a quantified and specific assessment of the resources required for obtaining a certain goal for the sector and second pre-feasibility and feasibility studies in order to start-up the actual execution of development projects in the fisheries industrial system.

UNIDO has a range of suitable methodologies and vast experience in their application for developing and executing the necessary support programmes for an integrated sector development. A common philosophy behind these methodologies is that they should be ultimately transferred to the developing countries themselves for use in the actual planning, management and monitoring of the development of the industrial sector under consideration.

Table 7.12. Technology expertise available in developing countries applicable to south-south co-operation[a]

Technology expertise	Country
Beach landing craft	Senegal, India
Ocean-going sail craft	South Pacific States, Caribbean
Lake canoes	Zambia, Tanzania
Small purse seiners	Peru, Ecuador, Thailand
Larger trawlers and purse seiners	Thailand, Morocco, Chile
Fish aggregating devices	Samoa, Philippines, Indonesia, Maldives
Long distance fishing	Cuba, Republic of Korea
Fresh fish culture	China, Indonesia
Prawn culture	Ecuador, Indonesia
Fisheries co-operatives	Belize, Indonesia
Dried fish products	Philippines, Thailand, area of Hong Kong
Frozen shrimp	India, Mexico, Brazil, Indonesia, Thailand
Frozen/canned tuna	Indonesia, Philippines, Mexico, Republic of Korea
Canned sardines, mackerel	Morocco, Peru, Ecuador, Chile, Thailand
By-products - fish sauce, shellcraft	Philippines, Thailand
Fisheries management systems	Malaysia, South Pacific states
Foreign fishing agreements	Mauritania, Mozambique, Maldives
Joint ventures	Indonesia, Sierra Leone, Ghana, Morocco
Integrated small-scale fishery projects	Philippines, Indonesia, Benin
Training - artisanal fisheries	Fiji, Papua New Guinea
Training - commercial fisheries	Republic of Korea, Morocco, Indonesia, Cuba
Training - aquaculture	Indonesia, Philippines
Training - boat building	Republic of Korea, Tanzania
Training - fish processing	Thailand, Peru
Research vessel operation	Indonesia, Morocco, India
Monitoring fish stocks	Thailand, Kuwait, Peru

[a] The above list is only a general indication of countries with experience and skills in the various areas. A comprehensive listing would be much more extensive but would also need to detail technologies and locations more precisely.

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Table 7.13. Technical assistance activities and investment requirements

Components	Activities	Investments	Examples of on-going activities
Resource management			
Surveys and research	Accoustic and biological surveys of biomass and fish stocks.	Research stations and vessels, staff training	Thailand - Resource surveys and stock monitoring. Gulf of Thailand. Kuwait - Fishery Research Station, vessels and ongoing stock monitoring. Somalia - Fridtjof Nansen (research ship) survey of offshore fishing stocks. UNDP/Norway programme.
Monitoring and statistics	Collection and compilation of catch/effort data and length/frequency data.	Fort fishery offices, samples programmes, log book systems.	S. Pacific - Log book system in force for all foreign fishing fleets.
Legislation and policing	Control of fleet size or power. Control of pollution environment. Control of fishing pressure or harvested amount.	Fishery protection vessels and/or aircraft.	Uruguay - Fishery survey with FAO research vessel "La Matra". UNDP Malaysia - New marine seas management regime, trawlers banned from coastal waters state licenses required for local areas, national licensing of commercial vessels. Coastal resources allocated to user groups. Artisanal fishing communities prtected. Resettlement schem ffor trawler fishermen displaced through licensing.
Conservation and enhancement	Control of capture of juvenile fish. Management of coastal zones and inland waters.	Production of larvae for stocking lakes or ponds. Construction of artificial reefs, replanting mangroves.	
Aquaculture	Promotion of fish farming by information, credit and technical assistance. Provision of culture services, fish fry, feed and fertilizers.	Establishment of fish hatcheries and fish farm services	Mexico - Establishemnt of fish hatcheries and fish culture. Indonesia - Extension services for fin fish and prawns. Government, bank and bilateral projects.
International waters	Co-operation with international fishery bodies. Development of economical long distance craft.	Design and construction or modification of vessels for distant water fisheries.	Morocco - Considerable new construction for offshore fleet. Private finance. India - National plans to replace thousands of existing wooden trawlers.
Extraction			
Artisanal fishing vessels	Protection of traditional fishing communities who have no alternative primary source of income. Socio-economic and cultural studies. Integrated projects involving all village activities including fishermen/boatbuilders, net makers, processors, tradesmen and artisans.	Assistance to local boatbuilders to upgrade the strength and efficiency of local craft, to incorporate alternative materials in construction and to manufacture simple pumps and hauling equipment. Community fishery centres, co-operatives, fishery extension services, village water supplies, roads.	Sri Lanka - Several fishing boat building projects. Senegal - Improvements to local beach landing boats - FAO. Somalia - Establishment of local g.v.p. boat factory. Bay of Bengal - Local construction of improved beach landing craft. FAO/SIDA. Indonesia - Fisheries Extension Project, FAO/UNDP.
Commercial fishing vessels	Rationalization of fishing fleets. Development of more energy-efficient craft and safety at sea. Upgrading of technology and skills in local boatyards, shipyards or marine workshops.	Research into fuel efficient engines and hulls, and development of alternative fuel motors. Construction of slipways and repair yards, equipped with marine engineering machinery and tools. Training of ship repair and installation personnel.	El Salvador - Integrated small scale fisheries project, FAO/UNDP. Benin - Artisanal fishing communities integrated project, FAO/DANIDA. Caribbean - Safety at sea for fishing vessels. FAO/IMO programme. Samoa and Somalia - Improvements to local sailing craft and development of new sail-assisted fishing boats.
Fishing gear and methods	Introduction and use of F.A.D.s, fish detection instruments and fisheries charts, appropriate offshore and deepwater fishing gear and techniques.		Bangladesh - Introduction of mechanical and hydraulic haulers on local fishing craft.
Vessel machinery and equipment	Introduction, improvement and promotion of blocks and tackles, hoists, derricks, hand winches, mechanical or hydraulic capstans adn winches, windlasses, net drums and polier blocks. Introduction and use of fish graders and conveyors on larger vessels.	Equipping local workshops to manufacture winches, captans, net reels, blocks and derricks. Establishment of marine hydraulic engineering depots. Upgrading training of local technicians.	Indonesia - Training of marine engineers, welders, machinists and operators. FAO/UNDP. W. Africa - Establishment of local service and repair workshops. Local/international sector.
Ice supplies and boxes/ containers	Improvement of basic cleanliness and insulation of fish holds, use of ice boxes and fish boxes, refrigerated or chilled sea water tanks, chilled or refrigerated fish holds as appropriate, improved fish handling and processing at sea.	Development and manufacture of locally suitable fish containers. Production and supply of insulation material. Install grading equipment on larger boats fishing for mixed quantities/sizes of species.	Peru - Rationalization and conversion of fish plants. Development and production of alternative packaging materials. Indonesia - Installation of sea water fish tanks on small local seine vessels fishing for sardine for canneries.
Fish ponds and fish cages	Propagation of information on pond and cage technology, construction, materials, fertilizing, mooring maintenance and repair.	Fish farming extension services. Local language technical literature.	Philippines - Bureau of Fisheries extensions and training services, U.S. aid, Fisheries Universities and Institutes, World Bank. Thailand - Fish culture development and extension service.

Table 7.13. Technical assistance activities and investment requirements (continued)

Components	**Activities**	**Investments**	**Examples of on-going activities**
Processing			
Ice plants and ice stores	Improve the quality and availability of ice. Provide well insulated storage bins or sheds. Develop passive cooling systems to minimize losses.	Small scale economical and efficient ice plants. Simple heat pumps for cooling stores. Insulated stores of local materials.	Indonesia - Rural development project, GTZ, assistance to ice plants, fish handling and marketing. Dominican Republic - Fish salting plant project, UNDP/TCP.
Traditional fish curing	Reduce losses and improve quality of cured fish.	Solar fish driers and solar desinfestation units, Tools and facilities for sea salt production.	Africa - Regional training programmes and courses on fish curing and processing. FAO/DANIDA.
Fish plant quality control	Train plant managers and personnel in quality control and hygiene. Establish standards and inspection services.	Modernize plants with hygienic facilities and equipment necessary for sanitation and cleanliness.	Bangladesh - Shrimp export quality control programme. UNDP. Djibouti - Fish marketing, ice plants and retail outlets project. U.S.aid
Energy-economical plants and processes	Survey energy consumption rates and investigate possibilities of economies in operation.	Improve insulation, energy efficiency by upgrading plants, and install more efficients units. Construct energy efficient buildings and use local renewable sources.	Peru and Venezuela - Research and development of more energy efficient processing equipment and methods. Guyana - Utilization of by-catch from shrimp trawling fleet. Research and development activities.
Low-cost packaging	Investigate substitute canning materials	Local material manufacturing plants.	
By-catch and trash fish utilization	Develop surimi and minced fish products. Initiate by-catch collection/landing schemes.	Construct appropriate local by-catch processing units and modifiy vessles for collection at sea.	
Marketing and distribution			
Fish landing places and market premises	Provide clean water, scrubbers and washing regimes for all fish markets and landing places.	Installation of SWS filters (fresh and/or salt water), pumps and storage tanks. Extend shade cover over fish handling areas.	South China Sea Area - Regional activities to support nationa efforts to improve fish markets and landing places. FAO/UNDP. El Salvador - Integrated fisheries project for small scale sector, improving capture, handling, marketing, boats, geare, water supplies,etc.
Fish landing and loading systems	Speed up fish landing, sale and loafing on transport in all markets.	Equip vessels with derricks or have them installed on piers, standardize fish boxes/containers. Install weighing machines.	Philippines - PFMA Navotas fish market project.
Transport and packing	Encourage standardization of fish containers and supplies of packing materials.	Manufacture of standard truck size insulated leak proof boxes.	Brazil - Artisanal fisheries project, Belem, GTZ, ice plants, boxes, transport. Indonesia - Sumatra and Java fisheries development projects, fish handling, distribution and marketing. ADB.
Cold stores and cold chains	Ensure continuity in frozen fish chains.	Refrigeration equipment, freezers, stores and display cabinest. Refrigerated trucks.	
Fisheries infrastructure			
Harbours, ports and jetties	Provide and improve harbours and landing places for marine fisheries. Survey coastal sites.	Dredging and surveys. Harbour and port construction. Jetties and piers for small scale fisheries.	Indonesia - Fishery infrastrucutre project, ADB and Sumatra fisheries project. New harbours, jetties, markets and facilities.
Boatyards and slipways	Enssure adequate slipping and docking. Facilities for the fishing fleet.	Docking facilities appropriate to fishing vessels and fleet size.	P.D.R. Yemen - New harbour project including fishery harbour and facilities. USSR aid. Training of local marine engineers and refrigeration technicians. FAO/UNDP.
Marine engineering workshops	Establish repair and maintenance services in all fishing ports, appropriate to needs.	Training of engineers and mechanics. Equipping of workshops in ports and boatyards.	Mozambique - Fishery harbour Beira and facilities. FAO and Italian aid.
Access roads	Ensure access to landing places for fish trucks, and establish distribution network.	Communications infrastrucutre, roads, bridges, fish transport vessels.	Indonesia and Bangladesh - Various fish transport/collection vessel projects. Barbados - New fish market construction project. ADB.
Electricity, fuel and water supplies	Provide water, fuel and power to isolated fishing ports where required.	Connection of harbours to national grids, extension of water supplies, installation of generators, pumps and storage tanks where necessary.	
Fish trade			
Domestic markets	Promote local consumption of fish food, develop new products, improve and maintain quality, reduce inefficiencies and bottlenecks.	Fish inspection services, advertising and publicity, institutional feeding programmes, retail outlets, display cases.	Mozambique - Establishment of local quality control and fish inspection services. FAO/UNDP. Latin America - Regional Training courses on frish quality control and processing, FAO/DANIDA.
Export markets	Raise quality standards to meet importers requirements fish for or cultre exportable species.	Training of plant operators, research and monitoring of processing methods. Credit for suppliers and exporters.	Philippines - Local cottage industry projects. Integrated Service Associations.
Non-food products	Encourage shellcraft cottage industries, utilize waste fish or offal for producing meal and oil.	Rural extension and training services, co-operatives, small reduction units.	

SOMMAIRE

Ce document présente une importante étude portant sur le système industriel des pêches dans les pays en développement.

L'étude se fonde sur l'analyse de nombreuses données portant sur 64 pays en développement dont onze font l'objet d'une monographie. L'étude évalue le système industriel des pêches dans 10 groupes de pays ayant chacun leur propre modèle de développement. Pour chacun de ces modèles on met en évidence les options stratégiques, l'investissement et l'assistance techniques requis. Sur les résultats de l'étude il est possible d'élaborer des programmes de développement intégrant l'ensemble du système de l'industrie de la pêche en s'aidant des méthodes habituellement utilisées par l'ONUDI telle que MEPS (Méthode d'Evaluation et de Programmation des Systèmes de Production et de Consommation).

EXTRACTO

Este documento presenta un estudio mayor preparado sobre el desarrollo de estrategias para los sistemas industriales de las industrias pesqueras en países en vías de desarrollo.

El estudio está basado en un análisis de una gran cantidad de información sobre 64 países en vías de desarrollo, incluyendo estudios individuales sobre 11 países. Evalúa el sistema pesquero industrial en 10 grupos de países según sus sistemas específicos de desarrollo. Para cada sistema de desarrollo se presentan opciones para formular estrategias y se describen los requerimientos para inversiones y asistencia técnica. Sobre la base de los resultados del estudio se pueden elaborar programas para el desarrollo integral del sistema pesquero industrial utilizando las metodologías standard de la ONUDI, como ser MEPS (Metodología de Evaluación y Programación de Sistemas de Producción y Consumo).

For the guidance of our publications programme in order to assist in our publication activities, we would appreciate your completing the questionnaire below and returning it to UNIDO, Sectoral Studies Branch, D-2073, P.O. Box 300, A-1400 Vienna, Austria

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QUESTIONNAIRE

Industrial development strategies for fishery systems in developing countries

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(1) Were the data contained in the study useful?	☐	☐
(2) Was the analysis sound?	☐	☐
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